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Advertisement Index, see page xxxii.

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Vol. LXXXV.] CONTENTS: August 29, 1919. [No. 2,179.

	Page
Industrial Relations	257
The End of a Review	258
Generator Ventilation and Boiler Draught	258
Curious Business Methods from America	259
The E.S.C.A.	259
The Magnetic Field round a Submerged Cable carrying Alternating Current, by H. R. Rivers-Moore (*illus.*)	259
Balancing and Alignment of the Alternator Rotor, by C. Sylvester (*illus.*)	260
Import Duties and Engineering Industry	262
The Government Statement as to Trade Policy	263
The Water Powers of the British Empire	264
Electric Traction in Mines (*illus.*)	265
Cable and Wireless Services	266
The Electricity Supply Bill	266
Correspondence—	
The Manufacture of Rheostats	267
An Aeroplane Factory Lighting (*illus.*)	267
Reviews	268
A Suggested British Empire Patent Law	269
Business Notes	270
Notes	275
City Notes	279
Stocks and Shares	279
Market Quotations	280
Mineral and Goods Traffic Electrically Operated, by T. Stevens (*concluded*)	281
The Faraday Society	282
Water Power in Canada (*illus.*)	283
The British Scientific Products Exhibition (*continued*) (*illus.*)	285
New Electrical Devices, Fittings and Plant (*illus.*)	287
New Patents Applied for, 1919	288
Abstracts of Published Specifications	288
Contractors' Column	Advertisement page xxiv

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INDUSTRIAL RELATIONS.

THE importance of the relations existing between employers and employed has received a considerably greater measure of recognition to-day, on both sides of the Atlantic, than ever before. It is true that, in general, it is the situation as between the capitalist as employer and the manual worker that is considered, and the relations between capital and the administrative staff—through which alone capital can accomplish anything—are afforded far less, if, indeed, they are afforded any, attention. We have previously shown, and the point must be driven home until it is appreciated by all concerned, that hitherto the staff has been expected, largely through having formed the habit of so doing, to act as the agent of capital. Trained brain workers, until within the last year or so, have never seriously considered the necessity of collective action for the protection and furtherance of their own interests. We hope that the great movements now generally known to be in progress for the achievement of these desirable objects may be accelerated and brought successfully through the initial difficulties that necessarily beset their course.

The interests of employers and employed can be, and ought to be, common. Both classes are parts of the community, and must desire the general good. The desire for the general good, however, is frequently overlaid by a grasping desire for more than a proper share of the results of industry, and this greed is not the exclusive attribute of either party. The owner of capital, particularly if taking an active part in the direction of business, wants a big salary and a big share of the profits. The manual worker not infrequently presses for a level of wages so high as to render it impossible to run the business at a profit. Each class, therefore, must be content to take from the products of industry, as a reward for services rendered, no more than a fair share, that industry as a whole may be enabled to produce goods for the general advantage of the community as a whole.

All who work for their living have certain definite elemental wants which must be satisfied, failure in this direction being inevitably followed by a greater or less degree of inefficiency. Among these may be mentioned adequate remuneration and a voice in the administration of affairs in which they are concerned. Comfort, not in the sense of luxury, but of a sufficiency of light, air, warmth, and accommodation, is also a prime necessity. Above all, a full feeling of confidence in the intention of the employer to play the straight game must be felt—there must be complete avoidance of tortuousness of mind, and of any lawyer-like disposition to quibble and take advantage of loopholes of opportunity to score off the less fortunate. Paternalism is undesirable, especially when it takes the form of doing things, however good in themselves, without consulting and advising with those who will be thereby affected. Human beings have ill feelings as well as good, but much can be done to bring out the best, when the bad will die of inanition. At least we may hope so, and the tendency will be that way.

As regards the question of remuneration, there is, of course, a perpetual difference of opinion between those who advocate payment by results and those who advocate a flat wage or salary. We think some system of payment by results is desirable. Profit-sharing and co-partnery (barbarous word) give poor and unsatisfactory results as a rule, and are seldom worth the trouble involved in administering them. For a commercial staff the most satisfactory basis would seem to be a combination of salary, commission on turnover, and bonus or premium on profits. For a

manufacturing staff the combination should be based on salary, bonus on shipments made, and some proportion of the profits, for a factory can very easily, by delaying the progress of a contract, turn a profitable venture into a loss. The salary should in all cases be adequate, so that the portion dependent upon results, if paid at infrequent intervals, does not get mortgaged in advance. The proportion of total remuneration formed by the results portion is unimportant, if this condition is fulfilled, but there should not on any account be an upper limit, nor should that part of the profits devoted to remuneration, and not to dividends, bear any relation to the salaries of the persons concerned. The individual salary, in a business of any magnitude, is a minute fraction of the profits made, and forms an unfair basis for the determination of the resultant. In the case of the manual worker, if a piece-rate is such that goods can be produced at a cost which will enable them to be sold profitably, it is unfair to reduce that rate if production is increased. This policy, which it is unwillingly admitted has been followed "in some cases," is quite directly and very largely responsible for the practice of "ca' canny" which is so objectionable. Now that psychology in industry is receiving a due—overdue in point of time—meed of attention, it may advantageously be borne in mind that the psychological condition of a man who feels himself to be underpaid is such as to be directly deleterious to his working capacity, to his employers, and to the psychological condition of those who are in contact with him. The infection spreads, as all infection does, and can only be cured by the creation of relationships which bring with them a thoroughly wholesome atmosphere. In the Army *esprit de corps* is rightly considered one of the fundamental needs of any fighting unit. If the right atmosphere exists in a business organisation, the members of that organisation will feel that they form a compact unit; that they are, in Biblical language, members one of another, and that whatever affects one member well or ill will, directly and indirectly, affect all similarly.

The End of a Review.

By order of the Minister of War—the Right Hon. Winston Churchill, M.P.—the Technical Supplement to the Official *Review of the Foreign Press* has been discontinued as from August 19th. This sudden decision in the direction of economy was arrived at under the influence of criticism levelled at the undertaking in a leading article in *The Times*. We can only regret the publication of the misguided criticism, assume that the writer was unaware of the value of the *Review*, and deplore the panic decision of the Government to make an appearance of economy. We have good reason for knowing that in the early years of the war there was a dangerous lack of technical and other information in certain Departments of the State, whose operations were vital in connection with the war. In these, as in some other respects, as a people we were hiding our head in the sand, indifferent in a remarkable degree to what was happening in certain European countries. A sense of loyalty inclines us not to particularise at the moment. The deficiency was removed to some extent by drawing upon the specialised intelligence and knowledge of the technical Press in London; it was also overcome by the setting-up of the now dethroned organisation which developed most usefully at a time when there were difficulties attending the efforts of the said technical Press to continue its study of Continental technical publications. While we, as editors, were furnishing information to the State, the State, through the restrictive measures of its officials, at times hindered our receipt of enemy technical papers—that by the way. The *Review of the Foreign Press* was essentially a war measure, but in the opinion of many who are capable of judging its usefulness, ourselves modestly among them, the publication and organisation abundantly proved their value. Our readers could judge our appreciation from our practice of quoting extracts in the Electrical Review. We understand that the organisation amply proved its value to trade and technical associations and to British manufacturers, and no doubt, though the Government activity in the matter has come to an end, the good work will be continued by somebody in some form. This had actually been mooted before the attack and the capitulation. For the present it has "ceased publication"—in other words, is as dead as a door nail, Mr. Winston Churchill and the Government have secured for themselves a reputation for economy—false economy effected in haste, and the Whitehall departments are in danger of lapsing into their pre-war state of ignorance. So learn we those lessons of the war by which Statesmen in their orations counsel us all to profit!

We have no desire that the Government should continue its war-time activities in the publication and sale of journals, nor do we desire it to relieve the technical Press of any of its legitimate functions. But we do most strongly object to the manner of its capitulation, as we have termed it. It seems to us to be little short of a pretence and a sham, and it reminds us of those who strain at a gnat and swallow a—12½ per cent. award.

There are some things which are essential for the well-being of the State, which it may not be easy to conduct as profitable commercial operations. The Surplus Disposal Board offers for sale its hundreds of millions value of war stores, but apparently an organisation and service of some technical value calls for no attention, save to scrap it "without leaving a trace." The State needs an efficient Bureau of Information, free from suspicion of private interest or control. The absence of such a Bureau midway in the war caused some Government offices to make deplorable exhibitions of themselves. We were asked several times over by different departments for the self-same information on matters of extreme importance, and once even by two different sections of the same department. The respective inquirers knew nothing of each other's search, and the ground had to be covered by us again and again. We were impressed very painfully with the need for co-ordination of effort. Are we going to fall back into our former inefficiency?

Generator Ventilation and Boiler Draught.

When visiting power stations one frequently comes across attempts on the part of the engineer responsible for the management of the plant to increase its efficiency by unusual methods. Sometimes the devices he adopts are indicated by special circumstances peculiar to his particular station, and sometimes they are born of a desire to push the application of a well-known principle to its logical conclusion. One such attempt which recently came under our notice consisted in carrying the heated air from the turbo-generators into the boiler room, there to be used as forced draught for the furnaces. The idea was primarily to promote efficiency of combustion, but a minor object was to get rid of the nuisance caused by the delivery of such large quantities of hot air into the engine room. It was claimed that a perceptible economy resulted from the arrangement. This claim we had no means of verifying, but quite apart from questions of economy, the disposal of the air in this manner avoided a good deal of unnecessary noise in the engine room, and, no doubt, made it more comfortable in hot weather. Obviously, too, other electrical machinery in the engine-room would gain in efficiency and capacity from the cooler atmosphere.

It may be worth while to look into the arithmetic of the question, with a view to gathering some notion as to what economy could be gained by dealing with the hot air in the manner stated. To fix our ideas, we will consider a load of 1,000 kw., as the same reasoning can be applied to any other load by merely multiplying the results by a simple factor. Suppose, then, that a load of 1,000 kw. is being carried with a generator efficiency of 95 per cent. Under such conditions 50 kw. of power is being continuously converted into heat, and this power is the equivalent of 170,600 B.Th.U. per hour. Assuming this heat to be all carried away by the ventilating air, and making the further assumption that the rise of temperature of the ventilating air due to its passage through the machine is 25° F., it follows that 28,600 lb. weight of air must pass through the machine per hour. This quantity of air is about what would be needed for the combustion of 1,590 lb. of coal, and supposing that

the station uses 3 lb. of coal per K.W.H., the air coming from the generators is sufficient to carry a load of 530 KW., on the assumptions made above as to the temperature rise. Alternatively the generator could supply all the air needed for combustion with a temperature rise of only about 13° F.

It is thus clear that the furnaces could easily take all the air passing through the generators, and heat would be saved in the station to the extent of about 170,000 B.TH.U. per hour for every thousand kilowatts of load carried. This, of course, is not much of a saving, as it is only equivalent to about one-half per cent. of the coal used. Nevertheless, it does represent a slight economy, and even if it be treated as negligible, the fact remains that there is no better way to dispose of the air than by utilising it where air is wanted. The ducts necessary to convey it to the boiler house are by no means of a formidable size, and with generator casings designed to discharge downwards, the ducts can usually be conveniently arranged along the ceiling of the basement.

Curious Business Methods from America.

On page 254 of our issue of August 22nd we quoted from an advertisement inserted by an American firm in a Rotterdam paper, which invited the co-operation of a salesman who would pay his own running expenses. From a recent issue of *The Iron Age*, we are enabled to discover that this is not the only example of a strange but complete inability on the part of some Americans to appreciate the conditions prevailing in Europe at present.

Mr. Robert S. Alter, vice-president and foreign manager of the American Tool Works, Cincinnati, complains bitterly that the American authorities in Belgium are selling surplus machinery to Belgian customers, delivered to destination, at 10 per cent. below the market value of new machinery. His suggestion is that this machinery, which is in unused condition, shall be *given* to the Germans, so that the Belgians may be obliged to buy new. This is indeed a remarkable way of appreciating and rewarding the nation that stood in the forefront of the war, and bore unaided the full force of the first terrific onslaught.

There is much to be learned, on the part of the British manufacturer, from careful observation of the American habit of mind at the present time. A time of prosperity, as we have found in our own case, becomes, with surprising speed and ease, a time of laxity and blindness, and the signs of the times seem to suggest that our most serious competitor in home and foreign markets will be, not full-fed and ultra-prosperous America, but starved and impoverished Germany. The German will be obliged to work hard to fill his stomach, and the only way by which we can make real and steady progress is by excelling him in work at least as fully as we have done in war.

The E.S.C.A.

These are the initials of the Electricity Supply Commercial Association, which, as will be seen from an announcement in this issue, is a very lusty infant, and is carrying on a lively campaign in the provinces. Originally known as the "Clerical Assistants' Association," this organisation was formed in April last year, and has already secured a large membership —nearly 2,000, we believe—and being the only body exclusively representing the commercial and clerical staffs in the electricity supply industry, it claims the privilege of protecting their interests in respect of salaries, working conditions, &c. The Association has been successful in securing equitable war bonus awards and salaries at several provincial centres, and has joined the Federation of Technical and Scientific Associations with a view to obtaining representation on the Whitley Councils by joint action; it is endeavouring to safeguard the interests of its members by amendment of the Electricity Supply Bill, and is taking other steps with similar objects in view. The existence of such a body is the natural corollary to the national adoption of the principles of the Whitley Report, and it should command the support of all who come within the scope of its constitution.

THE MAGNETIC FIELD ROUND A SUBMERGED CABLE CARRYING ALTERNATING CURRENT.

By H. R. RIVERS-MOORE, B.Sc., A.M.I.E.E.

It is interesting to consider the distribution of the magnetic field round a conductor carrying alternating current when that conductor is adjacent to or surrounded by a partially conducting medium.

There are many ways of regarding the problem, but a simple method is to consider the propagation outwards of the lines of force during the rise of the current in the conductor. In a more or less homogeneous medium these lines will take the form of concentric circles, but the higher the conductivity of the medium, the slower will be the rate of propagation.

The important practical case is that of two media of differing conductivities, such as earth and air or sea-water and air, and it is very desirable to know the probable

Fig. 1.—Suggested Distribution of Magnetic Field about a Submerged Cable carrying Alternating Currents.

distribution of the field near the bounding surface, in other words, at the point where the detecting coil is usually placed.

Fig. 1 represents a cross-section of a cable lying in a conducting medium—say, at the bottom of the sea—the medium being represented by the shaded portion. A B is the bounding line, and above this the medium is supposed to be non-conducting air. The magnetic lines will propagate first as concentric circles, but on breaking surface they will travel outwards more rapidly through the air, while that portion still in the water will continue to travel at a uniform rate. This will lead to a general distribution as indicated, the full lines representing lines of force as regards direction only, without reference to their intensity.

Fig. 2 represents an experimental determination of the direction of the lines of force at the surface of the sea over a submerged cable of length great in comparison with the

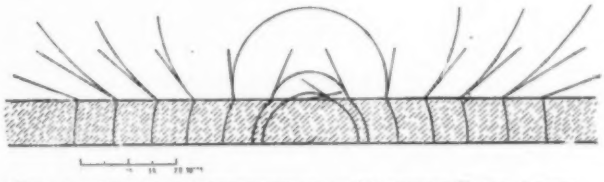

Fig. 2.—Supposed Distribution of Magnetic Field about a Submerged Cable carrying 3 Amperes at 500 Cycles per Second, derived from Determinations of the Direction of the Field at the Surface over a Long Cable.

dimensions involved in the test. The depth of the cable was about 4½ fathoms, and it carried alternating current of 3 amperes at 500 P.P.S. The field was explored by means of a coil of about 300 turns wound on a square former 3 ft. square, and capable of rotation about vertical and horizontal axes. The plane of the coil was set parallel to the direction of the cable, and the coil was then swung about a horizontal axis and positions of maximum and minimum induction noted by means of a headgear telephone connected across the coil. Readings were taken at distances every eight yards. The slopes at the surface are indicated and imaginary curves added after the manner of those in fig. 1.

The importance of the indications is at once apparent, if one considers an attempt to localise a submerged cable by means of a swinging coil such as has been described, or by any combination of coils equivalent to a swinging coil.

When immediately over the cable with the coil swinging about an axis parallel to it, maximum induction will occur when the plane of the coil is directed towards the cable, for it will then be at right angles to the magnetic lines of the field. At a distance of only eight yards, however, the divergence from this condition will be great. At about 15 yards the coil will lie horizontally to give maximum sound in the telephones, and after this *it will point away from the cable* altogether, until at distances of about 100 yards and upwards the "maximum" position becomes vertical, and it will be impossible to determine on which side the cable lies by the means described.

Complexity of the Field.—Another observation of importance is that the field appears to be complex. Owing, presumably, to a return current, or to eddy currents in the sea out of phase with the main current, the resultant field is rotating or elliptical. This is indicated by the fact that,

Fig. 3.

although positions of maximum and minimum sound are observable as the coil is rotated about a horizontal axis in the plane of the coil and parallel to the cable, yet there is no position of zero sound such as is obtainable when the plane of the coil is set perpendicularly to the cable. This absence of zero induction persists even to distances at which the maximum sound is weak.

Screening.—In certain tests in which a copper-sheathed boat was used, if the boat was turned so that the copper bottom came between the exploring coil and the cable, the above-mentioned effect was intensified, and it became very difficult to distinguish a maximum or minimum point at all.

Buried Cable on Land.—The writer's researches were chiefly confined to the case of the submerged cable, but figs. 3 and 4 are of some interest as indicating a similar distortion of the field in the case of a buried cable, owing to the conductivity of the earth. They also indicate the

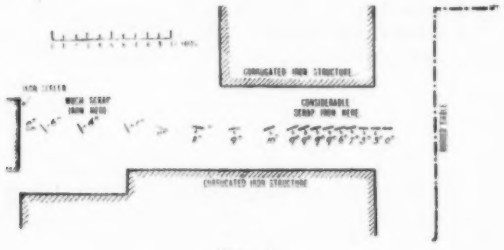

Fig. 4.

great disturbance resulting from the presence of metallic masses; a matter of special importance in the case of search coils carried on steel ships. The cable was buried about 14 in. deep only, and the current had a periodicity of 1,000 per second.

In this case, the cable was in the form of a loop of limited dimensions, and the test had to be taken near one end of the loop, as indicated in fig. 4.

Fig. 3 shows the positions of the coil for *minimum* induction at various points when the plane was kept parallel to the cable. That is, it shows the angle of the lines of magnetic force. It will be seen that they vary in precisely the same manner as with the submerged cable until the point is reached where great local distortion results from the proximity of an iron screen.

Fig. 4 indicates the positions of the coil for *zero* induction. The short lines represent in each position the angle of the coil to the cable. The arrows indicate the direction, and the figures the number of degrees that the top edge of the coil was moved from the vertical.

BALANCING AND ALIGNMENT OF THE ALTERNATOR ROTOR.

By C. SYLVESTER, A.M.I.E.E.

The balancing of the alternator rotor is not always completed in the erecting shop. It is very often necessary for the balancing expert to be sent to the site of erection of the turbo-generator to try to minimise the whip of the shaft, due, in some cases, to an unbalanced rotor.

The first indication of an unevenly-balanced rotor is excessive vibration just as the critical speed is reached. This is immediately followed by firing at the points on the alternator-end shields, where the rotor shaft projects through the shields near the slip rings. The clearance between the rotor shaft and the labrynth sectors connected to the end shields, in a 6,000-kw. Curtiss turbo-alternator, does not exceed ·010 in. If, owing to the whip of the rotor, these sectors commence to fire, the subsequent operation of balancing is simplified, since both the rotor shaft and the labrynth sectors will be marked at the points where they have been in contact. The balancing man can, therefore, carry out the adjustment of the balance weights with much more certainty than would be the case if he had no indication other than vibration to work upon.

The general arrangement for adjusting the balance weights on a turbo-alternator rotor is not generally understood. For the benefit of those who do not know, we illustrate the method in fig. 1. Here two weights, w,

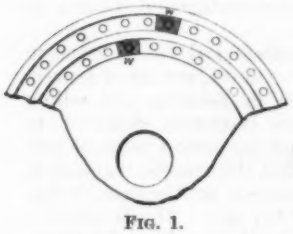

Fig. 1.

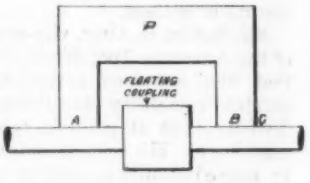

Fig. 2.

which are really pieces of flat steel, are free to move in either direction in their respective grooves. Each plate is held in its groove by means of a set screw which is screwed into holes drilled and tapped in the end of the rotor.

Each end of the rotor has two balance weights, so it will be seen that a very fine adjustment can be carried out. A good man at the job will have no difficulty in perfectly balancing a rotor in a very short space of time. These balance weights are fitted after the rotor is wound, to make up for any unevenness in winding. They have nothing to do with the original balancing of the rotor, which is balanced both statically and dynamically before the operation of winding is commenced. The method of obtaining a correct balance is by drilling out metal from certain portions of the rotor until a correct balance is obtained.

The statical balance of a rotor is very important, and it is found that if a rotor is perfectly balanced statically, there will be very little necessity for further balancing when it is placed in the alternator, and run up to speed. It may be said, however, that it is possible to have out of balance masses, such as the balancing plates previously referred to, arranged to balance statically, yet they may not be in balance dynamically.

Concerning balancing in general, a great deal has to be said for and against the methods of balancing adopted by the various firms which manufacture turbo-alternators, that is, when considering the type of bars used for balancing.

For very small armatures which have to run at high speeds, balancing on knife edges is very satisfactory. Larger armatures, say, up to a ton in weight, may be very nicely balanced on pieces of steel having a circular cross section.

For large alternator rotors, the balancing bars are of ample box section. The safe dimension of a good bar is that its depth should be at least one-eighth of its length, and the surface on the top of the bar should be sufficiently large to support a load, or weight, of 1,500 lb. per sq. in.

Apart from balancing, the alignment of the alternator

rotor is, perhaps, the most important feature in connection with the erection of a turbo-generator. Of course, every effort is made at the works where the machine is manufactured to minimise the trouble or possible errors which are likely to occur when the machine is erected in its position in a power station. Although these precautions are taken, they do not prevent mistakes being made which are not obvious until the machine has been run in, and is actually up to full speed.

The writer remembers how, a few years ago, a series of events occurred, in connection with the erection and test of a 6,000-KW. turbo-generator, which were very instructive to those concerned. This machine was erected in a large power station, and, of course, the usual trouble, such as easing the turbine thrust block and adjusting the governor and valve gear, was experienced when the machine was run in.

After drying out it was decided to place the machine on load. Before this was done, however, a small hole was drilled in the end plate of the exciter bearing in order that, by means of a depth gauge, any lateral, longitudinal movement of the rotor, beyond that allowed by the rotor thrust bearing, could be detected.

It must be remembered that the lateral movement of the alternator rotor is governed by the following items :—

1. An error in alignment.
2. An error in positioning the alternator stator.

In the case under consideration it was found that up to 75 per cent. of full load there was no lateral movement of the rotor. From 75 per cent. to full load, after two hours' run, a lateral movement of one-sixteenth of an inch was detected. The centre bearing cap which covers one end of the alternator rotor shaft and the turbine "wheels" shaft and coupling were removed, and the bearings were examined. Then it was found that the babbitt metal on the side of the rotor thrust bearing had been worn away to the extent of one-sixteenth of an inch.

During the two hours' run the temperature of the oil flowing from each of four bearings, was accurately determined, and in no case did it exceed 130° F. This was well under the 170° maximum permissible temperature allowed by the makers of the machine.

As above stated, the cause of the trouble was due to one, or both, of two items. The position of the stator was first checked, and it was found to be in the exact position upon the bedplate as marked at the works. Thinking that an error had been made, the stator was moved over towards the turbine for a distance of ½ in. The machine was again run up to full speed with full load upon it, and the lateral movement was again checked. After an hour's run it was found that the movement was increasing. It was therefore decided that the trouble was due to an error in alignment.

To check the alignment of the alternator and turbine rotors is not an easy matter, especially when it is considered that a long sensitive spirit-level will easily detect an error of ·0005 in. This can easily be understood when it is realised that, apart from machining errors, the weight of the turbine and generator will cause the spirit-level to show a deflection of sometimes as much as ·005 in., that is, from perfect levelling when the bedplate is grouted in, to the fixing of the turbine and generator upon it. It is, therefore, not wise to rely upon the reading of a spirit-level placed upon the machine bedplate, although specially machined levelling pads are left upon the bedplate for this purpose.

In the case under consideration the alignment of the turbine and generator rotors was checked by the method illustrated in fig. 2. Here P is a steel plate cut to pass over the floating coupling between the turbine and generator shafts. The two edges of the plate, A and B, were accurately ground. When the plate was placed in the position as indicated in the sketch, it was found that at the point C the edge of the plate was not resting upon the rotor shaft. This called for packing under the exciter pedestal bearing, and it was found that the insertion of a steel plate one-sixteenth of an inch thick was necessary before all four edges of the alignment plate were touching the two shafts. The rotor and stator shafts were then said to be in perfect alignment.

When the machine was again run up to full speed, and placed under full load, it was observed that the lateral movement was checked, but the oil temperature of the two inner bearings was considerably increased, due to the fact that the two rotor shafts were not in *perfect alignment*.

This may appear to be strange, but it is nevertheless true, that to distribute the load over a set of bearings having an intermediate bearing it is necessary to set the bearings out of line. This rule is practised by the makers of turbo-generators and other electrical machines—such as motor generators, &c. To make this more clear, we will assume that 1, 2, and 3 in fig. 3 are bearings, and that S is a turbine and generator shaft having a total weight of 20 tons. For the sake of simplicity, it is assumed that the weights of the turbine and generator rotors are equal; A is the turbine side and B is the generator side of the machine.

Now we can treat the two shafts as an elastic beam, since there is not sufficient clearance in the spigots of the floating coupling to allow any deflection of the shafts other than would occur if the coupling did not exist. This being so, as it is understood that the deflection of an elastic beam is in proportion to the load on the shafts, then the middle bearing must be set low in order to place more weight upon the two outer bearings. In this case the weight upon the centre bearing, provided all three bearings were exactly in line, would be about five-eighths of the total load, 12·5 tons; the end bearings would each carry three-sixteenths of the

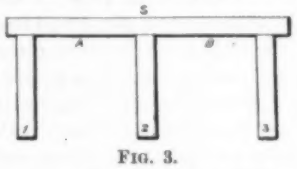

FIG. 3.

load, or 3·75 tons. Provided that it was decided to allow the bearings to be in perfect alignment, then it would be necessary for the centre bearing to be at least three times the length of each outer bearing. It would also be necessary to arrange for at least three times the amount of oil to flow to the centre bearing, not an easy problem, since the oil pressure would have to be increased in order that the bearing situated at the extreme distance from the oil pump would receive its correct proportion of oil.

It may be argued that, since the outer bearings are not carrying load in proportion to their design, the amount of oil to these bearings could be reduced. This is not so, because the amount of heat dissipated by the oil does not entirely depend upon the speed and friction of the shafts upon the bearings. The greater part of the heat to be dissipated is transmitted to the shaft from the turbine or the generator.

It is absolutely essential that the oil temperature should be kept as low as possible. The means available for doing this are as follows :—

1. By regulating the amount of oil through each bearing. It is far better to have the temperature of the three bearings at, say, 125° F., than to have two bearings at 115° and the other at 145°.

2. By regulating the amount and temperature of the cooling water through the oil cooler. Town main water is, of course, the coolest water to use, but it is very expensive. The ordinary circulating water can be, and is, used. Special arrangements should, however, be made for further cooling it before passing it through the oil cooler.

In the centre bearings of the turbo-generator previously referred to, the oil temperature was increased to 160° F., only 10° below the maximum specified by the makers. The use of town water to the oil cooler through a 1-in. pipe reduced the temperature to 145° F., there being a decrease in temperature of 20° at the oil pump. Special cooling arrangements for cooling a by-pass supply from the circulating water system reduced the temperature to 150°; this was with the power house temperature at 75° F. This was as much as could be done with the machine, because it was urgently required for service, and as such it was accepted by the Corporation concerned.

The lesson to be learned from the foregoing remarks is that, although a machine may be correctly designed, and in some cases partially tested at the works, errors are likely to be made which cause the outside erecting staff no little anxiety. When errors do occur the obvious thing to do is to overcome them in the most efficient and practical manner.

IMPORT DUTIES AND ENGINEERING INDUSTRY.

Memorandum Prepared by the British Engineers' Association.

"Whatever may have been the merits or defects of Free Trade in the past, the great changes that have taken place in the industrial and economic situation throughout the world demand a complete reconsideration of the fiscal policy of this country in the light of the facts and tendencies of to-day, and that some measure of protection, in certain cases going beyond mere anti-dumping legislation, will have to be provided for the engineering industry if it is to thrive to the extent required to afford any prospect of fulfilling the new standard of life expectations of the workpeople engaged in it."

In the above terms the Council of the British Engineers' Association stated the requirements of British mechanical engineering industry, preparatory to the appearance of its representative, Mr. D. A. Bremner, with other industrial representatives, on a deputation to the Prime Minister on July 25th. On that occasion Mr. Lloyd George requested Mr. Bremner to submit a concise written statement of the matter. This was duly forwarded on August 8th, and took the form of a memorandum on "Customs Imports Duties in Relation to the Engineering Industry." On August 18th the Premier made his lengthy speech on trade policy and other subjects in the House of Commons. That speech revealed little of the mysterious contents of the much-discussed locked box, but it cannot be said that the absence of anything new or particularly definite or detailed came as a startling surprise to those who had closely followed the terms of the various answers that had been given by Mr. Bonar Law and Sir Auckland Geddes to Parliamentary questions.

In brief, what Mr. Lloyd George did was to announce that import restrictions would cease on September 1st; that proposals would be submitted to Parliament to deal effectively with dumping; that the Board of Trade should be equipped with emergency powers to check a sudden and undue importation of goods at prices altogether below the cost of production in the United Kingdom owing to the collapse of exchanges; and that the Board of Trade should have power to prohibit the import, except under licence, of goods which are in competition with key industries.

Two of the chief considerations that arise for those interested in the various departments of engineering and allied industries will be:—What is dumping? and what, in the Government view, are key industries? As to the latter point, we should hardly expect there to be room for doubt as to the right of certain departments of the electrical and engineering industries to be classed as key or vital industries, when we remember some of the dangers that brought us so near to calamity in the early stages of the war; the record of national service demanded of engineering in bringing about the ultimate defeat of the enemy on the sea, on land, and in the air; and the great importance of these particular industries in assisting restoration, stabilisation, and industrial employment, in these difficult after-war days.

In the Memorandum referred to, Mr. Bremner first states that the question of Customs Tariff Reform as a whole involves considerations—political, diplomatic, military, national economic, and international finance and exchange, adding that no one industry, however great, nor any other sectional interest, however important, is competent to deal with all these considerations, and formulate a national policy. What he regards as the proper and only practicable course is for each industry, trade, or other sectional interest to submit its own special case to the Government, "which alone is in possession of the comprehensive data and information required for the intelligent examination of the problem in its entirety." We quote the following extracts from the Memorandum, in which he states the special case for the engineering industry, according to the views of the B.E.A. Council:—

The problem has never been and never will be capable of solution by mathematical processes or with a scientific degree of accuracy any process whatever. It will ever be impossible to forecast the net balance of financial advantage derivable from any given trade policy. The Government, with its expert advisers, and the vast store of information at its disposal, should, however, be able to determine the essential features of the policy that will yield the greatest net balance of advantage to British interests.

Such a policy will prove to be neither pure Free Trade, which we have never had, nor unadulterated Protection, but rather what may best be termed discriminative protection.

To-day, it is no longer necessary to advance arguments in support of the statement that the engineering industry is the greatest of all key industries, without which every department of our national life would be paralysed. Its maintenance in a state of progressive development is, therefore, a vital national necessity. Even if this were not the case, and we were merely exercising a free choice of industries to be specially encouraged and developed, we would, if we were wise, select the engineering industry, because it is a high-wage industry, and one of the few affording any prospect of fulfilling to any substantial extent the present-day standard of life expectations of the workpeople. This highly important fact has hitherto received but little attention, the publicity given to it having been almost negligible.

Tables are included showing the relative average weekly earnings in six classes of manufacturing trades in the year 1906, and the quantitative importance of the engineering industry revealed in the figures for 1913 (exports and imports).

The trade of the United Kingdom in the produce of iron and steel and engineering industries in the year 1913 was:—

Exports (value f.o.b.)	...	...	£130,673,748
Imports (value c.i.f.)	...	...	42,652,454

The magnitude of this export trade is second only to that of the textile industry.

Quite apart from its qualitative importance as a key industry these figures show that the engineering industry is an indispensable contributor to the means of payment for imports, and the maintenance of a satisfactory balance of trade. The economic situation left in the wake of the war makes it an imperative necessity to develop this great vital industry up to a standard of wealth productivity hitherto unprecedented in this country. If it failed us, what conceivable industry could take its place as a means of wealth production and high-wage employment for the workpeople engaged in it?

In view of the changes that have taken place in the international industrial world, it is more necessary than ever before that really effective legislative provisions for the prevention of dumping should be brought into force without delay, but, as the Government is definitely committed to that policy, arguments in support of it need not be advanced here.

Some Reasons why Import Duties should be Imposed on Engineering Produce.—Owing to the increased wages rates, reduced working hours, restricted output, and other causes beyond the power of the employer to compensate by his own ability and enterprise, the costs of production in this country have reached a point at which our power to compete in the export markets of the world is gravely impaired.

Unless the engineering industry can have a fair chance of securing a very large share of the home market, as a stabiliser, production on an economical scale, of the required variety of produce, will be seriously restricted, new enterprise will be discouraged, and a high rate of mortality may be expected amongst the smaller works and the infant industries started since the war began, whereby unemployment would be increased, and large capital investments sterilised.

The home market component of the employed industrial capacity of the country, *i.e.*, the home market component of the industrial "load factor," exercises a powerful influence upon the nation's ability to survive in the struggle for the export markets.

Abnormally high wages costs cannot possibly co-exist with an unchecked inducement to the wage-earner to spend his earnings on the competitive products of other countries where the wages cost per unit of value produced is substantially lower. The two conditions are mutually exclusive.

In addition to wages costs, there are taxation and other items in the cost of production, beyond the control of the manufacturer, which unfavourably affect our competitive power.

If the manufacturer be unable to sell his goods, either abroad or at home, where the cause of his impotence resides, his activities must speedily come to a standstill, and it would be interesting to know whence his discharged employés would expect to obtain the wages which even the engineering industry had proved unable to afford.

Imperial Preference should assist the fortunes of the engineering industry by increasing its chances of successful competition in a large and important section of the overseas market, and providing secure ground for the expansion of its productive capacity. It is, however, recognised that this

question involves many considerations lying outside the province of any one industry.

The memorandum sets forth the following essential conditions to be fulfilled by a trade policy :—

The consumer must be safeguarded from exploitation by the protected trades.

The export trade must be preserved and developed to the greatest possible extent, even at the cost of allowing a rebate equal to the import duty on foreign raw and semi-manufactured materials for re-export in a more advanced stage of manufacture.

Subject to any tariff which may be imposed under a system of Imperial Preference, all raw and semi-manufactured materials not producible in the United Kingdom should be admitted duty free.

Import duties should be imposed on raw and semi-manufactured materials producible in this country, though not yet being produced, provided that the facts and circumstances warrant the belief that a protective duty will induce their home production, but, unless that expectation be fulfilled within a reasonable time, the import duty should be withdrawn.

Obviously, the scientific adjustment of import duties for protective purposes must be based on the ratio of the cost of a given home-produced article, to the cost of a similar article of equal quality delivered c.i.f. United Kingdom from a foreign country of origin.

Import duties imposed primarily for the protection of home industry, and not for revenue purposes, must be high enough to protect, otherwise they merely act as an irritant to all concerned. Haphazard compromise in fixing tariff rates fails to meet the practical requirements of the case.

For example, in the case of an article manufactured in Japan, and delivered c.i.f. United Kingdom port, at a cost of £10, as compared with a British home production cost of £20, it would be futile to put on an import duty of even 50 per cent. *ad valorem*. The only alternatives in such a case are free import or prohibition. Although this hypothetical case may be an extreme one, it illustrates the absurdity of much that has been said and written about putting on "moderate" import duties. It also indicates the uselessness of some of the tariff schemes prepared by various bodies in which import duties of 5 per cent. or 10 per cent., or some other convenient figure, have been proposed, more or less haphazard.

The fact that, in the cauldron of war, the industrial and other economic conditions throughout the world have undergone a revolutionary change, and have been left in a seething state, as yet far removed from the stage of crystallisation, makes it extraordinarily difficult to devise a tariff, with any certainty that the rates of import duty will satisfy the conditions of even twelve months hence.

A thorough examination of the relevant new facts and circumstances and the acquisition of experience must precede the formulation of a so-called "scientific tariff." This will take some considerable time, but the industries of the country cannot afford to wait on counsels of perfection. In the meantime, it should be quite possible to decide the main features of our future trade policy, and devise such a scheme of import duties as would safeguard our home industries and permit of the withdrawal of the existing import restrictions and prohibitions, which, without being a source of any revenue, are disliked at home and viewed with suspicion and irritation abroad.

Subject to such revision by competent authority as may be necessary from time to time, these import restrictions and prohibitions must, however, remain in force until the Government has declared its trade policy, and they are either withdrawn or replaced by a tariff, as the case may be.

Subject to military and international political considerations, the practical merits of a national trade policy must be measured by its effects on the employment and earnings of the people and of the capital invested in the principal industries of the country.

The decisive test of the economic merits of any given set of conditions is the resultant sustained average purchasing power of the entire population, conditioned by the maintenance of an adequate minimum living wage, and the avoidance of gross inequalities in the distribution of the fruits of industry.

THE GOVERNMENT STATEMENT AS TO TRADE POLICY.

(Import Restrictions and "Key" Industries.)

With reference to the Prime Minister's statement in Parliament on Monday, August 18th, on the subject of trade policy the Board of Trade makes the following announcement as to the steps which are proposed in connection with imports of goods from abroad.

Legislation will be introduced when Parliament reassembles in the autumn :—

(*a*) For the protection of goods manufactured in Great Britain and Ireland against dumping by taking power to prevent the sale in this country of similar goods beneath their price in the country of origin.

(*b*) To enable the Board of Trade to check any flood of imports (for instance from Germany) that might arise from a collapse of exchange so disproportionate to costs of production in the country of origin as to enable sales to take place in this country at prices altogether below costs of production here.

(*c*) To deal with unstable "key" industries in the following way :—

A limited number of unstable "key" industries will be scheduled, the products of which will be prohibited from importation into this country except on licence.

Pending legislation, a general licence under the Prohibition of Import Proclamations will be issued by the Board of Trade having effect as from September 1st, 1919, and authorising the importation into the United Kingdom of all goods with the exception of those in the following list, which will be treated as unstable "key" industries :—

1. All derivatives of coal tar generally known as intermediate products capable of being used or adopted for use as dyestuffs or of being modified or further manufactured into dyestuffs. All direct cotton colours, all union colours, all acid colours, all chrome and mordant colours, all alizarine colours, all basic colours, all sulphide colours, all vat colours (including synthetic indigo), all oil, spirit and wax colours, all lake colours, and any other synthetic colour, dyes, stains, acids, colour acids, colour lakes, leuco acids, leuco bases, whether in paste, powder, solution, or any other form.
2. (i) Synthetic drugs (including antiseptics).
   (ii) Synthetic perfumes and flavourings, synthetic photographic chemicals, synthetic tamins, esters and acid derivatives of aromatic hydro-carbons, alkaloids and their salts (except quinine), and various organic chemicals.
   (iii) Analytical re-agents, and various fine chemicals.
3. Optical glass, including lenses, prisms, and like optical devices.
4. Scientific glassware.
5. Illuminating glassware.
6. Laboratory porcelain.
7. Scientific and optical instruments.
8. Potassium compounds.
9. Tungsten powder and ferro-tungsten.
10. Zinc oxide.
11. Lithopone.
12. Thorium nitrate.
13. Gas mantles and mantle rings.
14. Magnetos.
15. Hosiery needles, latch.
16. Gauges.

In addition to the above, in pursuance of the undertaking given by the President of the Board of Agriculture in the House of Lords on March 19th, 1919, the prohibition on the importation of hops will be continued for the present.

It is not proposed to make any addition to the above list unless and until Parliament so determine, with the possible exception that in the event of the contingency foreshadowed in paragraph (*b*) above arising, it might be necessary to suspend temporarily all or any of the imports from the country affected by the collapse of exchange.

Long Term Credits for Export.

The Board of Trade further announce that an office will shortly be opened under management appointed by the Board for furnishing sterling credits in accordance with the scheme for assisting the exportation of goods to certain disorganised parts of Europe, which was referred to by the Prime Minister in the House of Commons last Monday. The credits will be based on bills drawn in this country by the seller of the goods and accepted by the buyer, and will be subject either (*a*) to the deposit with an approved bank in the country of purchase of currency to an amount required by the office, or (*b*) to a guarantee of currency of a required amount by an approved bank, or (*c*) to arrangements for the handing over of produce of the buying country, or (*d*) to the deposit of securities with the approved bank or the office under the scheme. The office will fix periodically the amount of currency required to be deposited per £100 sterling, and will have power to vary its charges according to the nature of each transaction. The credits will continue for such periods as the office may determine in each case, having regard to the economic prospects of the country concerned and the character of the business, but the maximum period will be three years. The charges for each period of six months will be on a rising scale in order to induce early liquidation.

The office will be entitled (*a*) to take over and liquidate collateral pledges, (*b*) to have recourse against the acceptor of the bill for any deficiency, and (*c*) to have recourse against the guarantor. The credits furnished will not as a rule exceed 80 per cent. of the prime cost of the goods sold, plus freight and insurance (including the charge made by the office). In special cases, however, at the discretion of the executive the amount may be increased, but in no case will it exceed the prime cost plus freight and insurance (including the charge made by the office). If the proceeds of the Bill are less than the prime cost *plus* freight, *plus* insurance (including the charge made by the office), the loss represented by the difference will be divided between the office and the drawer of the bill in the proportion of four-fifths to one fifth.

Business will be taken only through banks and on the reports of banks, and the aggregate amount of credit to be granted will not exceed £26,000,000.

The area and classes of goods to which the scheme relates will be settled from time to time by the Government, but credit will not be furnished either for the export of raw material or for the sale of stocks held by Government departments.

THE WATER POWERS OF THE BRITISH EMPIRE.

THE second report of the Water-power Committee of the Conjoint Board of Scientific Societies states that the importance of developing water-power resources is becoming to an increasing degree appreciated throughout the more progressive portions of the Empire. The British Government has appointed a Committee to investigate the water-power resources of Great Britain and Ireland; in India two eminent engineers have been appointed by the Indian Government to investigate the more promising sites; in Ceylon the water-power question is being considered by a committee appointed by the Ceylon Government; in British Guiana the discovery of large deposits of bauxite has suggested a possible and immediate use for the enormous water powers which the colony possesses; in Canada the Government and community are fully awake to the necessity of such developments; in Australia a preliminary investigation ordered by the Government of New South Wales has been commenced, and in Tasmania developments are progressing as fast as conditions permit. A great desire to promote hydro-electric schemes is manifesting itself in New Zealand, and the Government is actively interesting itself in the investigation of promising schemes, and in the East African Protectorate, Government sanction has been obtained for the appointment of a special water engineer to organise a hydrometric survey of the Protectorate.

The committee draws attention to the intense interest in the development of their hydraulic powers, which has been in the immediate past, and is at present being shown by the majority of the European States. This has been largely due to the great demand for power for the manufacture of munitions, combined with the general world shortage of coal. In the countries at war, the normal development has been accelerated in a very large degree. Thus in France since the end of 1915, some 850,000 H.P. has been actually put into commission or is in process of active development, and by the end of 1921 the country will have at least 1,600,000 H.P. under control, as compared with 750,000 H.P. before the war. In Italy concessions totalling over 250,000 H.P. are already under way, and it is estimated that schemes totalling 2,000,000 H.P. will be in operation in a few years. In Norway, Sweden, and Switzerland large developments have been in train, while in Iceland a hydro-electric scheme contemplating the development of over 1,000,000 H.P. from the River Fjorsaavasdraget is planned by an Icelandic company. In Spain various large projects are under consideration, including one on the Douro which is estimated to be capable of giving some 350,000 H.P. In Bavaria a large project has been initiated to be financed in part by the State, in part by the various towns interested, and in part by existing stations; the total cost of the scheme is about 78 million marks. In Wurtemburg, Saxony, and Prussia the State is to participate in the development and administration of electricity works. In Austria some 433 falls, with an aggregate average yield of 1,500,000 KW., have been surveyed; of these 17 have been secured outright, while seven additional concessions are pending. The aggregate of these 24 schemes totals 135,000 KW. Other large hydro-electric schemes have been planned, and include an installation of some 25,000 KW. on the Talebor River, and one of some 120,000 KW. on the Wallsee.

The note in the first report relative to the electrification of railroads requires amplification in view of recent developments. In the United States, 440 miles of the Chicago, Milwaukee, and St. Paul Railway, comprising 590 miles of single track, have already been electrified, while contracts for the electrification of other sections of the line have been let, and on the completion of this work the total length of electrified track on the system will be about 860 miles. Electric power is obtained from hydro-electric stations.

In France much of the line of the Compagnie du Midi in the region of the Pyrenees has already been electrified with the aid of water power, and the electrification of trunk lines in many other countries is at present under consideration.

The figure quoted in the first report of the Committee for the water horse-power developed in the United Kingdom is much too low. The latest available statistics show that approximately 172,000 B.H.P. is developed in comparatively small units in the various industries, and, as this does not include the hydro-electric stations at Kinlochleven, and in North Wales, the total developed power is apparently approximately 210,000 B.H.P.

Some information has now been obtained relative to the water powers of British Guiana. The principal available water powers lie on the Essiquibo River, with its tributary the Potaro, the Mazuruni River, and the Cuyuni River. On the Potaro River, the Kaieteur Gorge has a total drop of over 1,000 feet. The Kaieteur Fall itself has a vertical drop of over 740 feet, the width of the head of the fall being about 400 feet when the river is full. In times of exceptional drought, however, the width shrinks to 50 or 60 feet.

No actual measurements have as yet been made by the Government of the colony, but it is evident that the potential water power of British Guiana is extremely large. Thus the Kaieteur alone at the fall and gorge, assuming a mean depth of 10 ft. over the fall, offers possibilities of 2.5 million B.H.P. The power developable in periods of drought, assuming a width of 60 ft. and a mean depth of five feet, would be about 125,000 B.H.P. As very extensive deposits of bauxite have been proved in British Guiana, the country would appear to be exceptionally well situated for becoming an important producer of aluminium for the Empire.

Hydro-electrical development in Canada has attained a stage far in advance of that as yet obtaining in any other part of the Empire, and the information given in the first report of the committee as to the organisation existing in the dominion for the collection of information as to water resources and their developments is amplified in the second report.

The Hydro-electric Power Commission of Ontario, in initiating a new development at Niagara, has issued specifications that show a notable increase in the size of units to be employed. This is known as the Chippawa-Queenston development. The water will be brought from beyond the Falls along a canal 13 miles in length, now under construction, and the total capacity will be 300,000 H.P. Specifications have been issued for four single-runner vertical turbines of 52,500 H.P. each, at 305 ft. head and 187.5 R.P.M. Tenders have been received from three well-known American firms. The generators will be of 45,000 kilovolt-amperes capacity at 80 per cent. power factor, 25 cycles, 12,000 volts. These turbines will be considerably the largest ever built. The highest powered machines now in operation are believed to be the two 22,500-H.P. units at 168 ft. head of the Washington Water-Power Co., Washington, U.S.A., with an overload capacity of nearly 25,000 H.P., and the largest in dimensions the nine 10,800-H.P. units, at 30 ft. head, of the Cedar Rapids Manufacturing and Power Co., St. Lawrence River, Quebec, Canada. The highest powered vertical turbines are the six 20,000-H.P. units of the Laurentide Co., at Grand Mere, Quebec, Canada. This Commission initiated, organised, and operates what is believed to be the largest electric transmission system in the world. It has ten systems in operation in Ontario. The largest is that known as the Niagara system, which now supplies 118 municipalities with a total population of nearly 1,000,000, the greatest length of transmission from the source of power being 274 miles and the main line voltage 110,000. Including the other nine systems some 225 municipalities are supplied by 3,000 miles of transmission lines.

A complete census of hydro-electric developments throughout Canada has been completed by the Dominion Water-power Branch in co-operation with the Dominion Bureau of Statistics, and shows a total of 2,305,310 hydro-electric H.P. now developed. This is an increase of nearly 33 per cent. over the less complete figures given in the first report of the committee. The increase in the last eight years has been 126 per cent. This brings up the developed hydraulic H.P. in Canada to 276 per 1,000 of the population. The most recent figures available for the United States indicate less than 100 H.P. Respecting capital cost, an analysis of the returns for 70 representative hydro-electric stations with an aggregate capacity of 746,000 H.P., omitting real estate, transmission, and distribution, shows an average total construction cost of £14 4s. per installed turbine H.P.

The chief electrical engineer of New South Wales estimates that 300,000 H.P. is continuously available from 18 schemes already investigated or partially investigated. The chief powers are on the Snowy River (137,400 H.P.); the Clarence (100,000 H.P.); and the Tumut, Shoalhaven and Nymboida (each about 10,000 H.P.).

In Victoria the large scheme for utilising the available water powers between the Kiewa and Snowy Rivers is still under consideration. It is estimated that the scheme will give more than 100,000 H.P. at an estimated total outlay on a pre-war basis of £878,000.

The Tasmanian Government hydro-electric department is continuing its policy of surveying, as opportunity permits, the more promising sites. At present the principal purchasers of power from the hydro-electric department are the Hobart Corporation for tramways and general municipal requirements, the Electrolytic Zinc Co., and the Hydro-Electric Power & Metallurgical Co., Ltd., which has installed works for the manufacture of calcium carbide. The present capacity of these works is 5,000 tons per annum, but it is proposed to increase this. It is estimated that the electrolytic zinc plant may eventually absorb up to 26,000 H.P. There appears to be every prospect of a ready demand for all the hydraulic power which can be developed by the department.

In Papua, or British New Guinea, taking all the rivers of any size, with their tributaries, in the Central, North-Eastern, Kumusi, and Mambare Divisions, it is estimated that the available horse-power would be somewhere in the vicinity of 6,000,000; and if the huge river systems in the Gulf, Delta, and Western Divisions were included, 10 million H.P. would be well under the mark.

In addition, it is estimated that the occupied territory of German New Guinea affords possibilities of between 7 and 10 million H.P.

A great desire to promote hydro-electric schemes is manifesting itself in New Zealand. The success which has attended the hydro-electric works at Coleridge is apparently having considerable influence in favour of constructing other power schemes throughout the dominion. A scheme for the development of three important sites in the North Island has been prepared. From these it is proposed to develop 130,000 H.P. requiring a plant capacity, in the main power stations, of 160,000 H.P. The scheme is intended to render power avail-

able for every householder in the island and for any industry; also for main-line electrification, light railways, and for coal and other mines. The sources mentioned are capable of supplying much more power than it is proposed to develop under the present scheme. Various new industries depending on the supply of electrical energy are either started or are proposed, and it seems clear that the Government will be drawn into extensive hydro-electric development for the whole of the dominion.

In Rhodesia a gauging of the Zambesi at a point five miles above the Victoria Falls shows that the volume of water was 11,750 cu. ft. per second. It is estimated that the available fall is 315 ft., which would correspond to an output of about 350,000 B.H.P.

In East Africa three projects, each of about 2,000 H.P., are being negotiated within 50 miles of Nairobi, and numerous smaller projects are being developed. In 1918 Government sanction was accorded to the appointment of a special water engineer to organise and carry out, so far as funds may allow, a hydrographic survey of the protectorate.

The committee emphasises the fact that an adequate supply of suitably trained engineers is essential to the attainment and maintenance of such a position in the hydro-electric world as is commensurate with the importance and capacity of the British engineering industry. It attaches great importance to the early provision of training facilities in one or more of the engineering schools in this country.

ELECTRIC TRACTION IN MINES.

Some progress has already been made in the installation of electric locomotives working from the pit mouth, and, in certain types of mines, into the main galleries, but it is not possible to take the large locomotives into the smaller galleries. There are certain prejudices against the use of such means of transport in mines, particularly coal mines, where there is risk of explosions due to sparking. It is believed,

Fig. 1.—Mine Entrance Tunnel.

however, that these prejudices will eventually be overcome as it should not be a difficult matter to render safe a self-contained battery locomotive.

Both *Modern Transport* and the *Commercial Motor*, from which the following particulars are taken, recently described some interesting experiments now being made at the iron-ore mine recently opened at Irthingborough, Northants, by the Ebbw Vale Steel, Iron and Coal Co., Ltd. At this mine con-

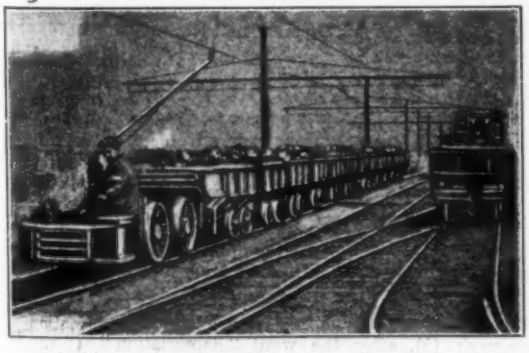

Fig. 2.—A Large Electric Mine Locomotive.

ditions resemble those generally prevailing in America, as the entrance to the workings is practically on the level, having been bored into the side of a hill. The workings are approached by a tunnel (fig. 1), within which there are two railway tracks of 3-ft. gauge, over which loaded trucks are drawn to the calcining plant by large American electric locomotives (fig. 2) which draw current at 250 volts from overhead wires extending down the tunnel. From the workings trucks are hauled to the main (overhead) system by means of self-contained battery tractors manufactured by British Electric Vehicles, Ltd., of Southport. We described some of this firm's trucks on page 136 of our issue of August 1st.

The tractors are charged at a charging station situated three-quarters of a mile within the mine. The initial charging current, supplied by a converter, is 34 amps. diminishing to 7 amps. at the end of the charge; the time taken for a full charge being roughly seven hours. Each B.E.V. locomotive hauls one truck, which weighs 15 cwt. unladen and 3 tons 10 cwt. when full, so that the actual weight of iron ore

Fig. 3.—B.E.V. Tractor in Mine Gallery.

carried on each journey is 2 tons 15 cwt. Up to the present the experiments with the B.E.V. tractors have, we understand, proved satisfactory. Fig. 3 shows one of them passing the mouth of a gallery.

The tractor battery consists of 24 cells of the "Ironclad Exide" I.M.V. 6 type manufactured by the Chloride Electrical Storage Co., Ltd. To facilitate handling, the battery is fitted in four trays and housed in two compartments at each end

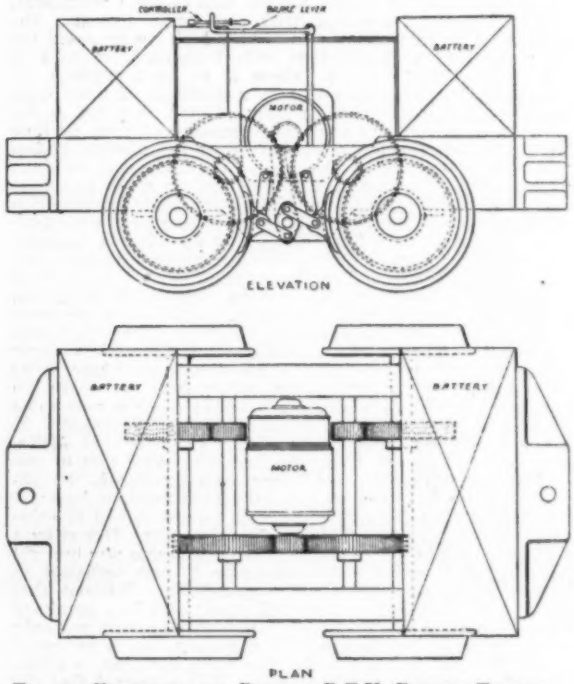

Fig. 4.—Elevation and Plan of B.E.V. Battery Tractor.

of the tractor, as shown in fig. 4. The motor is specially designed for traction purposes; all gear wheels are machine cut and case-hardened, and ball bearings are fitted to all moving shafts.

The drum type controller will stand currents up to 150 amps. continuously, and will give three speeds in either direction. The length of the tractor is 6 ft. overall and the wheel base only 2 ft. 4 in., so that it can easily negotiate sharp curves. At Irthlingborough the tractors run on a 3-ft. gauge, but they can be built for any gauge from 19 in. upwards. The rated speed is 6 M.P.H. when light and 5 M.P.H. when loaded; the rated mileage being 20 miles on one battery charge, but oy

boosting the daily mileage can be increased to approximately 30 miles. The tractors are capable of hauling a load of 10 tons on the level or of 3 tons up a gradient of 1 in 40. We understand it has not been possible so far to compile any statistics of costs of transport by tractor compared with animal or human means of propulsion, but battery tractors possess undoubted advantages, and they will probably play an important part in the haulage of coal and ore in mines in the future.

CABLE AND WIRELESS SERVICES.

Empire Press Union's Report.

In response to an invitation from Lord Milner's Committee, appointed to deal with the subject of improved cable facilities, the Empire Press Union selected a sub-committee to offer suggestions for that object. Though the sub-committee consisted of gentlemen immediately connected with the Dominions and Indian Press, its deliberations were intended to cover the needs of the general public as well as those of the newspapers. We give below a brief abstract of the sub-committee's report.

The commercial classes and the Press have suffered together during the past four years of cable chaos. The Eastern cables suspended, for a time, the transmission of messages at Press rates, and Press messages sent to the Antipodes on the already overcrowded Pacific cable were so heavily delayed as to be almost worthless when they arrived at their destination. The newspapers were not spared this disappointment though they used the full rate of 3s. a word for the majority of their communications—a charge of five-fold the Press rate tariff. On the Eastern service the Government wordage rose from a pre-war average of 3,000 words a day to over 50,000. For many weeks the Eastern route was so heavily loaded with work for the Far East, and chiefly for the Government, that the Eastern companies declined to take any Press or public messages to the southern hemisphere. India was long ago deprived of the old Indo-European line, and was compelled to take many cable messages through America and Japan; the whole Australian service was thrown upon the Pacific route of a single wire line. Now that the war has ended, it is possible to consider how an improvement can be brought about. An extension of the wireless system has many advocates; wireless has great potentialities, and it has already made great strides. It is for the Government to settle whether wireless should be in public or in private hands. India has an efficient internal system for the uses of the Government, but no regular connection with the world systems. The erection of at least one station of very high power would put all India into communication with high-power stations in other parts of the world. There is so great urgency for improved communications that as a provision of large wireless stations can be more speedily effected than the laying of long sea cables, this committee recommends that no time be lost in deciding how an extension of the wireless system will meet the needs of the hour. Wireless messages from Carnarvon have been picked up by relatively small apparatus in Australia; also small receiving instruments in operation in India obtained the first authentic news of the German losses in the Jutland fight by picking up wireless messages of the German Government. This committee is assured that the world communications by wireless would be greatly facilitated if extra powerful stations were built in India, Australia, Montreal, and Vancouver. But it may be some years before transmission of messages by wireless can approach the certainty that is now attained on cables, and however good wireless may prove to be, cables are not likely to be supplanted. Unfortunately, the cables have to make up great leeway. The Eastern Co. hopes to finish a new cable from England to Gibraltar before the end of September. It has a project on hand for an additional cable from Malta, down the Red Sea to Singapore, and it is hoped that in two or three years this work will have been completed. If subventions have increased commercial communications by mail, it is reasonable to expect that a well devised system of cable subvention will also be fruitful of good results. It was by a sound system of subvention that the Pacific cable was brought into existence, and the flow of traffic is now sufficient to relieve the guarantors of all responsibility. Without that means of communication, the world would have been paralysed during the war; the Pacific cable was able to carry not only the messages of the Australian Government, but it proved of great assistance to home authorities when the Eastern cables were overcrowded, or broken down. It is a marvel that the Pacific cable has lasted seventeen years without a fracture in its deepest part. Unfortunately, the Pacific cable has one long unbroken stretch of 3,980 miles, which section constitutes the bottle neck of the whole service. In order to make sure of that route being maintained, a new cable should be laid throughout—from Bamfield to Norfolk Island, and certainly, in the first instance, from Bamfield to Fanning Island. This would be an important link in the "All Red" route which the Empire Press Union has advocated for several years; the necessity of the "All Red" route is admitted by every authority. It may be considered that the Government's acquisition of the German cable to America *via* the Azores, now extended to Halifax, is sufficient for the Atlantic link of that route. But it is not a quick cable, and it is in the hands of the bureaucratic Post Office. When the large number of American-owned cables that cross the Atlantic are remembered, and the favoured treatment of American Press messages, it is surely not too much to hope that a British Empire cable will soon be laid from Ireland to Newfoundland, whatever use may be made of the newly acquired cable *via* the Azores. The link from Halifax to Bamfield is already covered by the Pacific Cable Co.'s lease of the Canadian Pacific Railway wire. That wire is not a Government property; it works well westwards from Montreal, but between London and Montreal there is frequent trouble. It is a matter for consideration whether the Pacific Cable Board could not take over the ex-German cable, *via* the Azores, from England to Halifax. Since the armistice, and notably this spring, up to 1,000 words a day were sent under the 3s. rate. For two or more months the Eastern Co. could take no public or Press cablegrams of any kind. Owing to the breakdown of several of its wires, the company was unable to handle anything more from London than the very heavy Government messages. Another important improvement in the cable service that would be welcomed would be the creation of an "urgent" rate between England and Australia. Thirty-one countries accept "urgent" telegrams; these messages take precedence of other private telegrams, and are charged for at triple rates. Great Britain is not among the 31 countries referred to. This is a matter of great importance to the public as well as to the newspapers.

To sum up, the committee suggests that:—

1. Immediate steps be taken to improve the existing cable services by reducing the wordage of Government messages, and otherwie relieving the present congestion on the wires.
2. Every possible assistance be given by the Government to the cable companies to enable them to expeditiously repair their lines.
3. An adequate system of wireless be established as soon as possible.
4. A second cable be laid without delay, as a part of the "All-Red" scheme, from Bamfield to Norfolk Island, and certainly, in the first instance, from Bamfield to Fanning Island.
5. Better use be made of the ex-German Atlantic cable.
6. Subventions be granted with a view to reducing cable and wireless rates, in order to encourage intercommunication between all parts of the Empire.
7. The deferred Press tariff should be resumed, and extended as soon as possible to South Africa and India.

THE ELECTRICITY SUPPLY BILL.

In view of the interest which has been excited by the Home Secretary's having withdrawn his amendment, by which the words "less depreciation" were to be omitted from the purchase clause of the Bill, the following extracts from the "Parliamentary Debates" will give our readers the official facts of the case.

On the orders for the day for July 31st, the Home Secretary's amendment stood as follows:—

Clause 7, page 5, lines 5 and 6, leave out "less depreciation."

During the debate on that day the following occurred:—

Mr. Shortt (Home Secretary): . . . If you take compulsorily away from a concern its generating station, and it can be shown you thereby cripple the rest of the concern, that is an exceptional circumstance, and practically the only exceptional circumstance which we had in mind. . . . If the companies are prepared to accept some such words as those with the same meaning, and to submit to be bought up less depreciation, I am more than content.

Later on in the morning the following was moved by Mr. G. Balfour: In sub-section (2), paragraph (*b*), after the word "depreciation" ("less depreciation") to add the words "but with the addition of a sum as compensation for any damage shown to have been sustained by any company, body, or person due to the severance of the generating station or main transmission line."

Major Barnes moved as an amendment to the proposed amendment at the end, to add the words, "always having regard to the value of the obligation in sub-section (5) of this clause."

Words, as amended, there inserted. [The Home Secretary did not move the amendment standing in his name. It would appear that there was a misunderstanding—the Home Secretary being under the impression that Mr. Balfour's amendment was in substitution for his amendment, whereas Mr. Balfour and others contended that it was in addition and not in substitution therefor.]

On August 5th Mr. G. Balfour moved in sub-section (2), paragraph (*b*), after the word "depreciation" ("and the acquisition of the site thereof, less depreciation"), to insert the words, "but including an additional sum as compensation for the unexpired tenure of such generating station or main transmission line." This amendment, he said, goes on the same lines as the amendment which stood in the name of the Home Secretary, and which has been removed from the paper. I think we have a right to raise the point.

Mr. Shortt: Quite so.

Mr. Balfour: It was on the paper the last time the committee sat, and we were left under the impression that the matter would be covered by the Home Secretary.

Mr. Shortt: It was agreed that the two amendments were not to be moved.

Mr. Balfour: We did not discuss any of the amendments. It is quite possible that there was some misunderstanding. I am quite ready to admit frankly that it is possible, and I can quite see why the Home Secretary possibly did think I meant his other amendment to be amended. I said so. The hon. Member for Oxford (Mr. Marriott) crossed to ask this question, and returned to say it was quite understood that the other amendment would stand. I frankly admit that in my desire to facilitate proceedings, and being a new member—you will understand the difficulties under which a new member labours in these proceedings—I have been the cause of putting the committee to some trouble in the matter. But the committee will agree that, no matter how much trouble we are put to, and however unfortunate I may have been in causing it, it would be a disaster if we should pass the purchase terms on which everyone is to be settled with in the future on any basis which is unjust and unreasonable. That is why I have put this amendment down again in manuscript. I have endeavoured to assist the Government on all occasions to prevent them being in the position of inserting in this Bill anything which would look like extracting the maximum terms from the companies. I desire to see the Government take the minimum terms which are fair, just and equitable. The Home Secretary put down an amendment in which he stated he was willing to pay the cost of the generating station and the main transmission line without any deduction for depreciation. Before the war you have £100 invested in a generating station. Under 1888 terms to-day you would pay £220 or £240 for that, less depreciation. If you take off depreciation from that you would arrive at a figure of from £160 to £200, according to the newness of the station. That is under the terms of purchase which any local authority would have to pay at the date of maturity. That would save the State from £60 to £110. The Home Secretary refuses to give £100 for a legal claim of from £160 to £200. He is adopting an entirely unfair position. Is he going to withdraw from that position? If not, it is nothing but plain, brutal robbery. . . .

[Amendment negatived.]

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Manufacture of Rheostats.

I notice in the current issue of the Review under the heading "New Electrical Devices, &c.," some interesting information under the title "Improved Rheostats."

I agree with your remarks that these resistances were made entirely in Germany prior to the war, and it is perhaps well known that Messrs. Ruhstrat, of Gottingen, were the largest makers.

I am particularly interested in the illustration under fig. 2, as I happen to know that the particular article shown is of original German manufacture, and has never been made in this country up to the time of writing, and to me it seems unfortunate that a foreign production should be illustrated in your journal in connection with text which would tend to lead the public to believe that it was of British design and manufacture.

Further, the use of fire-enamelled and other forms of steel tube, wound with superficially oxidised wire, and slate rheostats having wire wound in grooves cut in the edges, together with the use of graded windings, were all introduced by German firms several years prior to the war, and cannot be considered as modern improvements.

I want it to be clearly understood that I am interested in the manufacture of these types of regulating resistances, and use all the features above cited, and therefore I am naturally desirous that the trade and public should know that my firm, in common with other manufacturers, have copied and not originated these particular features.

L. F. Fogarty.

Ruislip, *August 25th*, 1919.

[Messrs. Isenthal & Co. inform us that the pamphlet from which we derived the illustration, fig. 2, on p. 236 of our last issue was sent to us in error: it is not in circulation, and has been superseded by Section II. of their new catalogue, which is now in preparation. The rheostat illustrated in fig. 2 was never sold in this country. While both tubular and slate rheostats were of German origin, we are informed that many improvements have been embodied in the British-made patterns which have been placed on the market by Messrs. Isenthal.—Eds. Elec. Rev.]

AN AEROPLANE FACTORY LIGHTING.

The importance of good lighting in factories is universally recognised in theory, but is often ignored in practice. It is possible by improvements in artificial lighting to increase production by 11 per cent., to decrease spoilage by 25 per cent., to reduce accidents by 25 per cent., to achieve a higher standard of workmanship, to maintain daylight efficiency throughout the night shift, and generally to increase the efficiency, comfort, and satisfaction of employés.

The points summarised in the previous paragraph are not merely disputable arguments, they are facts which represent the considered opinion, not only of the majority of progressive factory owners, but also of the British, French, and American Governments. Moreover, the total operating cost of an artificial lighting installation on the most up-to-date lines, including interest on investment, depreciation, maintenance, and power cost, is roughly one-half of 1 per cent. of the wages bill, so that even if good lighting costs a little more than

Fig. 1.—Sopwith Aeroplane Factory Showing General Lighting.

bad lighting, it is obviously uneconomical to waste comparatively expensive manual labour in order to save a few pence in lighting costs.

During the war close attention was paid to this question of lighting in all munition and aeroplane factories, because it was realised by the authorities that without efficient illumination maximum production was absolutely impossible. A good example of artificial lighting scientifically designed to meet the requirements of maximum 24-hour production is afforded by the installation in the Sopwith aeroplane factory at Ham Common, Surrey. In the wartime manufacture of aeroplanes the two chief considerations were speed and accu-

Fig. 2.—Main Bay of Factory Showing Uniformity of Lighting.

racy of production, and in order to ensure these characteristics it was obviously essential that the artificial lighting should be adequate, comparatively shadowless, and entirely free from glare. In the case of the Sopwith factory these illumination qualities are assured by the use of Mazda half-watt type lamps in B.T.H. "Industra" semi-indirect fittings equipped with opalescent reflector bowls. The large main bays, shown in our illustrations, are lighted by 1,000-watt lamps, in pendant type fittings, suspended at a height of 30 ft., and 42 ft. apart. In the galleries 300-watt lamps are used, also in semi-indirect fittings.

The average illumination intensity throughout the factory is 3.5 ft. candles, which is amply sufficient for every process involved in the manufacture of aeroplanes. A study of the illustrations, which are reproduced from untouched photographs taken by the unaided light of the Mazda units, will

indicate the approximate uniformity of the illumination, and the absence of hindering shadows.

This installation is a good example of modern industrial lighting practice. General lighting is employed because it is the only practicable method in large shops in which it is desired to have uniform illumination over the entire area, including passages and alleyways, so as to give complete freedom in the location of machines and work benches. And, of course, a general lighting installation is considerably easier and cheaper to install and maintain than a local lighting system with innumerable small units involving a constant risk of breakage.

The need for maximum production is as great now as it was at any time during the last five years. Good lighting,

Fig. 3.—Industra Semi-Indirect Fitting.

which did so much to aid production during the war, is of equal value to peace-time industry.

Fig. 1 shows the general lighting with 1,000-watt Mazda half-watt lamps in "Industra" semi-indirect fittings in the main bay of the Sopwith aeroplane factory. Fig. 2 is another view of the main bay, showing the uniformity and comparative shadowlessness of the lighting, while fig. 3 is the B.T.H. "Industra" semi-indirect fitting, as used in the installation.

The lamps and fittings used in the Sopwith installation were manufactured by the British Thomson-Houston Co., Ltd., of Rugby.

REVIEWS.

Papers on the Design of Alternating Current Machinery. By C. C. Hawkins, M.A., S. P. Smith, D.Sc., and S. Neville, B.Sc. Pp. xv + 392, 97 figs. London: Sir Isaac Pitman & Sons, Ltd. Price 18s. net.

This book is a collection of four papers dealing with the design of slow-speed and high-speed alternators and of induction motors. It is not intended to constitute a complete treatise—as would be impossible in a volume of the size—but deals with the theory of the subject generally, and with some of the more difficult problems of design in particular. There is little co-relation between the papers, but the authors consider that they have an added value if read in the sequence in which they are presented.

The book is of a class that cannot be too heartily welcomed. All its authors have undoubted academic qualifications, and in addition, at least two of them are engaged in the actual designing for commercial purposes of the class of electrical machinery with which they deal. There is thus the happy combination of the application of the academic mind to the solution of the practical problem, and of equal importance, the practical mind applied to the academic problem. Designers of the old school who achieve success as much by inspired guesswork as by philosophy may look somewhat askance at the wealth of detail with which the authors concern themselves, particularly on the subject of the turbo-alternator. With the large and expensive modern turbo-alternator, however, the importance of forecasting the behaviour of the machine with the greatest possible accuracy cannot be over-estimated, and any development of designing procedure that aims at such a result is completely justified, even though some additional work is involved. The two determining factors of this policy are the very low cost of designing a large alternator, compared with its value, and the virtual impossibility of making alterations once the machine is built. With smaller machines, errors of design can often be corrected by rewinding some part or by improving the ventilation, but after the modern turbo-alternator is completed any effective alteration involves complete reconstruction, at disastrous expense. The work of the authors, therefore, in aiming at the most precise methods of design is entirely praiseworthy.

The book contains much that is original, and no designer or advanced student who takes his work seriously can afford to be without it. The first paper is by Dr. Smith, and deals with the general theory and design of alternators, and there is worked out the design of a slow-speed alternator and of a turbo-alternator. Dr. Smith has the happy gift of being able to present the very complicated subject with which he deals in a very clear and readable form, and few students or designers can fail to profit by reading this paper. The same remarks apply to the fourth paper, also contributed by Dr. Smith, on the subject of the theory and design of the induction motor. The second paper, written by Mr. Hawkins and Mr. Neville, deals with the magnetic circuit of the turbo-alternator with a cylindrical rotor, and with the shape of the flux wave. With the very high magnetic densities in the rotor of the modern turbo-alternator, the accurate determination of the exciting current is of vital importance, and the thorough and logical manner in which this difficult subject is treated constitutes an important addition to the little that has so far been published. Mr. Neville contributes the third paper on the subject of the magnetic calculations for tapered teeth and for slotted structures generally. For the most part the work is quite original, and Mr. Neville is to be congratulated on his achievement. The paper has the hall-mark of clear and logical thinking, and furnishes striking evidence of how precision is now taking the place of approximation in modern machine design.

It is regrettable to see such an excellent book marred by a number of inaccuracies that the exercise of a little more care could have prevented. A drawing is given in the first paper of a 2,000-kw., 3,000 r.p.m. turbo-alternator, arranged for axial ventilation. There is shown a small duct for the air inlet, and one of exactly similar size for the air outlet, and a calculation shows that if there passed through the machine the volume of air that the author specifies, the velocity through the two ducts would need to be about 18,000 ft. per minute—an impossibly high value, having regard to the path of the air flow. The fact of the author providing for a mean air velocity through the axial ducts in the machine of about 4,000 feet per minute, shows that he has no lack of knowledge on the subject, and to anyone familiar with this class of machine it is fairly clear that there has been an error of draughtsmanship, the stator shown being in every way of the conventional pattern for radial ventilation instead of being arranged for axial ventilation. Moreover, although a correct drawing of the stator segment is given in another illustration, fig. 18b, it is incorrectly shown in fig. 18. In the same paper there is given a drawing of a 750-kw., slow-speed alternator, fig. 13, showing the poles, the rim and the wheel centre cast integrally in steel with the hub unsplit. The diameter of the pole circle is nearly seven feet, and the probability of an unsound casting due to cooling contraction would be considerable. It is unsatisfactory to put forward such a design for students and others to copy. The stator segment in this drawing is also shown incorrectly. In the last paper there is given a drawing, fig. 18, of a 100-h.p. induction motor. The design of the bearing has been arranged for a split bush and split housing, but these parts are shown unsplit, and it would be practically impossible to assemble the motor. Screws are provided for adjusting the bearing bracket to give a uniform air-gap, but the brackets are registered without clearance on the stator frame, and so the object of the screws is defeated. Moreover, the adjusting screws are provided at the slip-ring end, but not at the driving end—another oversight.

The fact that the book will be read widely by students should have impressed the authors with the importance of avoiding any expressions likely to mislead the inquiring but inexperienced mind. There is, however, a number of statements that are likely to be misunderstood. In the first paper the author would lead his readers to believe that the alternator driven by a water turbine has to be especially constructed because its normal peripheral speed is so much greater than that of the engine-driven alternator. This statement may be true in some cases, but the main reason for the difference in construction lies in the great overspeed of about 80 per cent. of a water wheel against only 20 per cent. or less with an engine. In the same paper, when speaking of a cast-iron rim for an alternator rotor, the author states that the poles "must be bolted on," whereas it would appear that he really means to say that steel poles and a cast-iron rim cannot be cast integrally. It is an unfortunate statement to put before a student since there are other and perhaps preferable methods of attaching poles to a rim, that do not involve the use of bolts.

When calculating the stator core loss, the author employs an empirical formula of which the origin is not given. Nowadays, designers work to the "total loss" figures furnished by the core steel makers, and whatever may be the imperfections of such a method, it constitutes the only convenient means of comparing one quality of steel with another. With the various qualities of core steel now available at widely different prices, it is one of the designer's responsibilities to decide between quality and price. No reference is made to this matter, and the omission is the more important because the author uses the same values in the loss formula for the core steel for a turbo-alternator as for a slow-speed alternator, thus implying that the same quality should be used for the two cases; in general such would not be the case. The section that deals with mechanical stresses gives a table showing the factors of safety in the various parts of the turbo-alternator rotor, but in the absence of the minimum permissible values the table can have but little value to those who may consult it for the purpose of acquiring information. Also, the stresses are calculated at the normal running speed, and no reference is made to the much greater stress at the test over-speed. On page 126 the radius of gyration is referred to as "the radius of the centre of gravity." When dealing with the important subject of the ventilation of a

turbo-alternator, the author says: "The problem of the air supply in a turbo-alternator does not resolve itself so much into what we want as to what we can get under the given conditions of head and resistance to air-flow." The designer has the head of air somewhat under his control, and the other factor, the resistance to airflow, is practically altogether under his control. The head of air is regulated by the rotor diameter, and providing ducts to permit of the flow of the necessary volume of cooling air is one of the most vital factors that the designer needs to observe. It is therefore decidedly wrong for the author to tell his readers that the air-flow is not regulated by the designer.

A feature of the book is that it is prefaced by a list of symbols. Anyone who has been concerned with symbols for electrical work must be too well aware of the many difficulties involved to be very critical, and there would have been little to say on this subject had it not been for the hope expressed by the authors that the list they give will be adopted by other writers. A careful examination of the book gives the impression that this ambitious hope is not likely to be realised, since the authors are quite unable themselves to adhere to the list given. Dr. Smith departs from the list occasionally, principally with regard to subscript letters, and presumably these departures are accidental. Mr. Hawkins and Mr. Neville, however, both break away from the list quite openly, and Mr. Neville even gives a list of his own. To take a typical case, "x" in the general list stands for "reactance"; in Mr. Neville's list it stands for "width of slot," but as actually employed it expresses "width of tooth." For a list of symbols to have any value it must be entirely dependable, so that when the book is consulted in a hurry the meaning of all the symbols given in the formulæ can be found without fail by referring to the list.

The book is well printed, is singularly free from misprints, and has the type of binding that a reviewer at least appreciates, that causes the book to remain fully open at any page without the use of paper-weights.

The imperfections, to some of which reference has been made, are of very small importance compared with the great merit of the book. The book should be in every technical library in the country, and should be at the elbow of every student who seeks to master his subject, and of every designer concerned with the production of important electrical machinery.—S. F. B.

A SUGGESTED BRITISH EMPIRE PATENT LAW.

The following report of a committee on patent law amendment, which was adopted by the Council of the Institution of Electrical Engineers on July 14th, appears in the July issue of the *Journal*:—

Numerous schemes for enabling patent protection to be secured expeditiously and at a reasonable cost in the whole or in certain parts of the British Empire by means of a single patent have been proposed from time to time, but most of these, though at first sight apparently sound and likely to be beneficial, have the serious practical drawback that to make them effective would involve radical changes in the existing Statute Laws of the different parts of the Empire.

The scheme outlined in this report aims at carrying out what should be the main objects of any Empire Patent Law, viz.:—

1. Low cost.
2. Ease of application throughout the Empire.
3. Reciprocity.
4. No change involved in the existing laws of the Empire.
5. Adherence to the scheme optional by any Dominion.

Under this scheme any person may obtain an Empire patent covering as many of the British Dominions, Colonies, Dependencies, and Protectorates, collectively referred to in this report, for convenience, as territories, as he may select, by making application to the British Patent Office. The fees payable will be the sum of the existing local Government fees in the selected territories, plus such small fee as may be charged by the Britsh Patent Office to cover the expense of carrying out its part of the scheme. The application will be examined and the patent granted in the same way as is an application for a British patent, and the specification when printed will bear the names of the selected territories in which it is effective. Thereafter the patent will be assimilated with the domestic patents in each of the selected territories, and will be subject to the local laws in such territories for the determination of validity, infringement, and all other questions affecting letters patent after grant.

In the appendix will be found a list of the 48 Dominions, Colonies, Dependencies, and Protectorates of the Empire which have their own separate enactments for granting patents.

It is clearly desirable in the interests of inventors and of the public and industry generally that the cost and trouble of securing patent protection throughout the Empire should be materially reduced.

Careful consideration has been given to the suggestion that a patent should be obtainable covering the whole of the British Empire in the same way that a patent in the United States covers all the States in the Union, but there are so many difficulties connected with such a scheme that it is not felt any practical result can be expected of any attempt to elaborate a proposal along such lines. It is believed that the present scheme is practical, and has the merit that it can easily and immediately be put into operation without disturbing the existing laws in the various territories in the Empire.

It is assumed that usually an inventor will apply for a patent first in that part of the Empire in which he is domiciled or has his business or manufacturing establishment, in order to secure wthout delay protection for his invention, and it is not proposed that the existing Patents Acts or Ordinances in the various parts of the Empire should in any way be disturbed. (This, however, does not mean that the Governments of the various Dominions, &c., should not be urged to amend their laws so that they may all be made as uniform as possible in at least their principal provisions.)

The scheme proposes that in each territory a short Act or Ordinance should be passed to the effect that any Empire patent which has been made applicable to such territory shall be received and treated by it in all respects as though such patent were a patent which had been granted under the territorial Patent Law. This is important, for otherwise there would exist two classes of patents, and difficulties might arise in interpreting them in the Courts and elsewhere. The fact that the form of the specification and claims of the Empire patent might differ somewhat from that of the domestic patent should not give rise to any practical difficulties.

It is obvious that such an Empire patent as is proposed, in order to secure uniformity, which is essential, must be issued from one centre, and that centre it is suggested should be the British Patent Office.

It is recommended that the Empire patent should be applied for and issued in the same way as a British patent. Where a British patent has been applied for or obtained, the Empire patent will be a duplicate of it.

An applicant residing in any part of the British Empire may apply for a patent either in his own Dominion (being a Dominion granting a patent) or in any other part of the Empire granting a patent, and shall have a sufficient period —18 months is suggested—from the date of his first application in any part of the Empire in which to apply for an Empire patent. An Empire patent if applied for within such period shall have a priority date as of the date of application for the corresponding patent first filed in any part of the Empire.

This provision should not give rise to any difficulties, as the practice would follow that of applications for patents under the International Convention, which gives a period of one year within which applications may be filed in any of the countries belonging to the Convention.

To carry out the scheme it would be desirable to establish an Empire patent department of the Patent Office in London, in which all applications for Empire patents would be filed, and the appropriate fees paid, in respect of the selected parts of the Empire. To this department would also be paid at the appropriate times such renewal fees as may be necessary for keeping the Empire patent in force in such parts of the Empire as the patentee desired to maintain the patent. The Empire patent department would transmit through the appropriate channels the fees received and due to each of the Dominions, &c., in respect of the Empire patents issued, and also the renewal fees, if any, paid on such patents to keep them in force.

It is urged that whilst it would be highly desirable for all parts of the Empire to adhere to this scheme for an Empire patent from the outset, it is not necessary that the adoption of the scheme should be delayed until this has been achieved. Valuable progress would result if certain parts only of the Empire decided to adopt it at first, and power were given to other parts of the Empire to adhere to the scheme at a later date.

It is strongly recommended that the Empire patent should rest on its own foundation in each part of the Empire. This naturally follows from the suggestion that the Empire patent should be assimilated with the domestic patents in the various parts of the Empire, and read and interpreted in accordance with the law and practice obtaining in each part of the Empire. If, for example, in an infringement or revocation action or like proceeding in the United Kingdom or in any Dominion, the patent were declared invalid, this should not affect its validity in another Dominion in which the validity of the patent was not attacked or in which such an attack failed owing to the circumstances being different. These are substantially the conditions which obtain at present in respect of the separate patents issued by the various Dominions.

As to the fees payable in respect of the Empire patent, it would be very desirable for the various Dominions to agree on a scale of reasonable fees to be payable on application for a patent and at uniform times for the renewal of the same during its term. It is realised that the fees payable at present in respect of both these conditions vary considerably in the different Dominions, in some of them being very reasonable and in others inordinately high, and that the amount of fees payable do not in some cases correspond in amount with the extent of the territory covered or the volume of the trade in a patented article which may reasonably be expected to be done in connection therewith. However, for the same reasons that the establishment of an Empire patent has been advocated along the lines contained in this report, and in order that objections to the early commencement of

the scheme may not be raised by the various parts of the Empire on the ground of loss of revenue, it is suggested that the fees payable in any of the Empire territories should remain as they are at present. It is believed, however, that the reduction in fees which is recommended would be more than made up in the total amount received by the greatly increased number of patents applied for in the various Dominions under the present scheme.

It might be suggested that if the fees in the various Dominions are not reduced no great reduction in the cost of protecting an invention by patent in the Empire under this scheme would result. This, however, is not so, as the cost at present is not so much due to the Government fees payable as to the expenditure necessary in preparing, filing, and prosecuting an application for a patent separately in each of the Dominions.

W. M. MORDEY,
Chairman of the Committee.

June 21st, 1919.

APPENDIX.

Empire Dominions, &c., having their own separate enactments for granting patents.

Australian Commonwealth, Bahama Islands, Barbados, Bermuda, British Guiana, British Honduras, British Solomon Islands Protectorate, Canada, Ceylon, East African Protectorate, Egypt, Falkland Islands, Federated Malay States, Fiji, Gambia, Gibraltar, Gilbert and Ellis Islands Colony, Gold Coast Colony, Grenada, Hong-Kong, Hyderabad, India, Jamaica, Johapur, Johore, Kedah, Kelantan, Leeward Islands, Malta, Mauritius, Mysore, Newfoundland, New Zealand, North Borneo, Nigeria, Nyassaland Protectorate, Rhodesia (Southern), St. Helena, St. Lucia, St. Vincent, Seychelles Islands, Sierra Leone, South Africa (Union of), Straits Settlement, Travancore, Trinidad and Tobago, Uganda Protectorate, Zanzibar.

BUSINESS NOTES.

Coastwise Trade.—In consequence of the withdrawal of coastwise steamers a large volume of traffic has been diverted from sea to rail, with the result that the railways are now burdened with traffic which they have not previously carried. The absence of normal coastwise shipping facilities is impeding the transport of the food supplies of the nation, of the raw materials needed in our mills, factories, and workshops, and of our manufactures for export, and thereby the cost of living is advanced, the re-establishment of our industries and commerce is retarded, and the difficulties of finding employment are increased. In these circumstances there is urgent necessity to relieve the railways of such traffic as can reasonably be carried coastwise. The continued application of pre-war rates to the carriage of goods by rail offers strong monetary inducements to traders to use the railways for all goods, including those which can be sent forward as conveniently coastwise, but the unrestricted use of the railways is interfering with the flow of traffic through the ports, and thereby placing limitations on both imports and exports. There is therefore urgent necessity to use to the full the coastwise services, but they can only be re-established on a pre-war footing by being assured of a reasonable amount of regular traffic. Full services cannot be maintained if they have to depend on the carriage of casual traffic which is from time to time shut out by the railways. To meet these difficulties the War Cabinet have given directions to the railway companies that no goods which have been imported foreign, or which are intended for export foreign, shall be carried by rail between points which can be effectively served, in whole or part, by coastwise carriage. For this purpose schedules of traffic will be prepared by the Home Trade District Transport Committees in consultation with representatives of the railway companies on those committees, and all goods included in such schedules (whether transhipment goods or otherwise), will be carried, in whole or part, coastwise, at the freights and charges then current, and on the terms and conditions set forth in the Sailing Bill, conditions of carriage and/or Bill of Lading Form then in common use for other similar cargo carried coastwise.

The difference between the freights and charges so paid (other than demurrage), and the amount of the railway rates and charges which would have been payable if the traffic had been carried by rail will be refunded by the Railway Executive Committee or their agent to the trader by whom the payment has been made. All applications for refunds must be lodged within three months of date of forwarding of the traffic. All persons having goods to forward under this arrangement must lodge an application in the form annexed with the Home Trade District Transport Committee for the district from which the goods will be consigned, and must follow the directions given by that committee as to the route and means by which the goods are to be forwarded. Traders will greatly facilitate the prompt carriage of goods by lodging their application forms at least ten days before the goods will be ready for shipment. The districts for which Home Trade District Transport Control Committees have been appointed, and the address of each of such committees, to which all communications are to be sent, are given below. This arrangement is entirely of a temporary nature, and subject to termination at any time.

Home Trade District Transport Committee.

Bristol (covering the Bristol Channel).—Secretary, Mr. E. A. Clark, 25, Great George Street, Park Street, Bristol. 'Phone 4720.
Glasgow (covering West of Scotland).—Secretary, Messrs. Purdie, Glen & Co., 55, West Regent Street, Glasgow. 'Phone, Douglas 1400.
Hull (covering the Humber and East Coast Ports).—Secretary, Mr. T. W. Prickett, Land of Green Ginger, Hull. 'Phone 4660.
Leith (covering Edinburgh and East Coast of Scotland).—Secretary, Mr. G. C. Duff, 8/9, Commercial Street, Leith. 'Phone 602, 603 and 604.
London.—Secretary, Mr. O. C. Baylis, 1, Seething Lane, E.C.3. 'Phone, Avenue 4826.
Mersey (covering Liverpool, Manchester, Birkenhead, and West Coast Ports).—Secretary, Mr. J. W. Lester, 211, Tower Buildings, Liverpool. 'Phone, Central 6335.
Newcastle (covering the Tyne and Tees).—Secretary, Mr. C. E. Hull, Mercantile Chambers, Newcastle. 'Phone, Central 898.

The Profiteering Controller.—The President of the Board of Trade has appointed Mr. W. J. Hands, O.B.E., to be Controller of the Profiteering Act Department. All communications in connection with the administration of the Act should be addressed to the Controller, Profiteering Act Department, 1, Queen Anne's Gate Buildings, Westminster, S.W. 1. (Telegraphic address, Profactdep, Vic. London.)

G.E.C. Boy Scouts' Summer Camp.—The G.E.C. Boy Scout Troop (184 Midland), which consists of "Witton" boys, held its Summer Camp this year during August holiday week at Hunstanton, the camp being pitched on the golf links adjoining the beach. Favourable weather was experienced, and the 51 members who attended had a good time. A full programme of events was carried out with a maximum of success. These included a troup cricket match, Cricket Match *v.* Dunlop Scouts, athletic sports, Football Match *v.* Dunlop Scouts, boxing tournament, excursion to Sandringham, and last, on the evening before the return, a camp concert. Every credit is due to Scoutmaster W. Wilson for the success of the camp.

Fire.—Fire occurred on August 20th in the electric motor house at the works of the Redheugh Sheet Iron and Steel Co., Gateshead. The building was gutted, and the whole of the electrical equipment rendered useless.

Non-Ferrous Metal Industry Act.—A list of further additions to licences granted under this Act was published in the *London Gazette* for August 19th.

Bankruptcy Proceedings. — Cecil Saul Nathan, 99, New Bond Street, W., company director, &c.—The creditors under this failure met by adjournment at the London Bankruptcy Court on August 22nd, before Mr. F. T. Garton, Official Receiver. A statement of affairs was submitted showing total liabilities £5,482, of which £5,065 is expected to rank, against assets 10s. 8d. The debtor formerly carried on a contracting agency business for the Brush Electrical Engineering Co., and also on his own account at 39, Victoria Street, Westminster. He has also acted as director or otherwise of a number of companies, including Engineering Proprietary. Ltd., Ives Engineering Co., Ltd., Draycott Engineering Co., Ltd., Weldon Engineering Co., Ltd., Associated Aircraft Co., Ltd., Motor Maintenance, Ltd. (lately Tooting Aircraft, Ltd.), Aircraft Consolidated, Ltd., Cowper-Coles Aircraft Co., Ltd., and Wm. King & Son, Ltd. The debtor attributes his position to the failure of Engineering Proprietary, Ltd., to discharge its liabilities. In the absence of any offer or resolution, the case was left in the hands of the Official Receiver to be wound up in the usual manner.

Stamped or Pressed Metal-Wares Trade. — The *London Gazette* for August 26th publishes a notice of the intention of the Minister of Labour to make a special order applying the Trades Boards Acts, 1909 and 1918, to the above trade.

Patent Restoration.—An order has been made restoring Letters Patent No. 6,887 of 1913, granted to W. B. Good & Robesi, Ltd., for "An Automatic Morse Recorder."

The Change-Over at Armstrong, Whitworth's.—Messrs. Sir W. G. Armstrong, Whitworth & Co., Ltd., have issued through their Central Commercial Department, 8, Great George Street, Westminster, S.W. 1, a fine brochure of between 50 and 60 pages, describing the company's war-work in the production of battleships, guns and gun carriages, naval gun mountings, ammunition, cartridge cases, fuses, shipbuilding, aviation, aeroplanes, airships, &c. A brief concluding chapter alludes to the extensive scheme of reconstruction and re-arrangement of the works at Elswick, Scotswood, and Openshaw, for the supply of commercial products on a large scale, including turbine and internal combustion engines, engineers' tools, and machine tools. The engine works department has been amalgamated with the firm of A. & J. Main & Co., Ltd., as Armstrong, Main & Co., Ltd., and the motor-car department with Siddeley-Deasy & Co., Ltd., as the Armstrong, Siddeley Co., Ltd.

Liquidation.—Wedmore Engineering Co. (1919), Ltd. —Winding up voluntarily with Mr. W. Johnstone, "Perivale," Cornwall Avenue, Church End, Finchley, as liquidator.

Book Notice.—"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVIII, No. 8. August, 1919. New York: The Institute. Price $1.

The Birmingham Fair.—Firms who intend taking space at the British Industries Fair (Birmingham), which is to be held from February 23rd to March 5th, 1920, should send in their applications without further delay, in order that the grouping scheme may be carried out to their satisfaction. Communications should be sent to the General Manager, British Industries Fair (Birmingham), 1920, Chamber of Commerce, Birmingham.

The Engineers' Amalgamation Scheme.—According to Press reports, meetings were held on Monday in London and Liverpool in support of the scheme for amalgamating the A.S.E. and other engineering Trade Unions in one body, to be known as the Amalgamated Engineering Union. The *Manchester Daily Dispatch* says that the A.S.E. report for 1918 shows that the membership exceeds 312,000, and the total funds aggregate £2,633,000. If the present scheme goes through, there will be in the new Union 500,000 members, and the funds will amount to £3,500,000.

Strike at Halifax.—From the *Leeds Mercury* we gather that a strike has been in progress during the past six weeks at the works of the Campbell Gas Engine Co., Halifax, the employment of ex-Service men as trainees being the ground of the disagreement. It is stated that the company last week issued an invitation to those disapproving of the strike to resume work not later than September 1st, with the guarantee that if they were expelled from their Trade Union for so doing, similar benefits to those they would have had by remaining in the Union would be forthcoming through the company. An Approved Society, it was indicated, would be established under trustees to ensure this. On the top of the standard rate of pay the company would institute an individual bonus system of payment on output.

Catalogues and Lists.—Messrs. Simplex Conduits, Ltd., of Garrison Lane, Birmingham, have just resumed the publication of their house magazine, *Installation News*. No. 1 of the new series is dated August, and it mentions, as a matter of historic interest, that "Simplex" becomes of age this year, the company having been formed in 1898. There are editorial notes, comments predicting a boom in electric domestic appliances, and "Remarks at Random," by Simple Simon. The Simplex Roll of Honour gives the names of 19 men who fell, out of a total of 124 employés who joined the Forces. There are some observations on better conduit wiring, and some appropriate after-war notes.

Siemens Bros. Dynamo Works, Ltd., Palace Place Mansions, Kensington Court, London, W. 8.—12-page illustrated list fully describing the "Zed" fuse system, showing the various patterns and tabulating prices, weights, dimensions, &c.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C. 4.—Catalogue of "Freezor" electric fans (V Section, tenth edition, 28 pages), the contents of which have been revised, bringing the list into line with prevailing conditions. Stocks of the more standard lines are held, and manufacturing facilities for the production of the remainder are being speeded up. A general description of the Freezor fan is followed by illustrated particulars and prices of desk and bracket-patterns, ceiling types, centrifugal fans, exhaust fans, wall and porthole pattern, and of automatic shutters and speed regulators.

Messrs. Walter Jones & Sons, 61, Victoria Street, London, S.W.1.—Illustrated sheets showing electric power station buildings, aeroplane sheds, engineering offices, and other premises erected by them.

New French Companies.—The Société pour l'Étude du Chemin de Fer Métropolitain de Marseilles has been formed at Paris, with a capital of 300,000 fr., for the construction of an underground railway at Marseilles.

Under the style of L'Installation Electrique, a company has been formed at Paris, with a capital of 250,000 fr., to carry out electric installations.

The Société Hydroélectrique des Dranses is the style of a concern started at Paris, with a capital of 262,500 fr.

The Société Française Electro-Radiologique has just been formed for the manufacture in particular of radioelectric medical apparatus, and also generally of electric and mechanical appliances. The company's capital is 300,000 fr., and its offices are at Paris.

The Société d'Electricité et Gaz du Nord has decided to increase its capital from 35,000,000 fr. to 40,000,000 fr.

Electrical Exhibition at Turin.—On the initiative of the Turin branch of the Associazione Elettrotecnica Italiana, an International Electrical Exhibition is to be held at Turin in the spring of next year. The exhibits will be confined to household fitments—lighting, heating, and small motors, with accessories. A model house is to set forth the varied applications of electricity to domestic purposes.

Patents and the Peace Treaty.—Article No. 307 of the Treaty of Peace provides that a period of one year from the coming into force of the Treaty shall be granted to the nationals of the contracting parties for compliance with the obligations prescribed by the laws of the respective States for the protection of industrial rights, and Article No. 308 extends the time within which foreign applications under the International Convention for which it is desired to obtain the priority of a British application must be lodged to a period six months after that date. The Chartered Institute of Patent Agents therefore points out that patentees should decide whether they wish to protect, in any of the countries concerned, inventions which they have patented since August 1st, 1913. The Board of Trade has sanctioned the payment of fees to Germany, Austria, Hungary, and Turkey in respect of patents, designs, and trade marks.

Australian Industrial Developments.—According to a Sydney newspaper dated June 30th, Standard Waygood Hercules, Ltd., proposes to extend its business, and to manufacture in Australia the whole of its requirements, except possibly wire-rope and wrought-iron piping, two articles which require an expensive plant, of which the output could not be absorbed in Australia. It hopes to be in a position to manufacture generating plant, such as that for want of which some of the electric supply stations cannot overtake the demand for their output. The company has accordingly acquired a controlling interest in G. Weymouth & Co. Proprietary, Ltd., of Melbourne, and Mr. George Weymouth, founder of that company, has gone to Sydney to join the board and to take charge of the manufacture of electric motors and generating machinery.

Amalgamation of Tube Companies.—According to the *Financial Times*, a company has been formed, with the title Tube Investments, Ltd., for the purpose of combining, by an exchange of shares, the interests of Accles & Pollock, Ltd., Credenda Conduits Co., Ltd., Simplex Conduits, Ltd., and Tubes, Ltd. Messrs. Babcock and Wilcox, Ltd., will acquire 100,000 shares, and their managing director, Mr. J. Kemnal, has joined the board of the new company. The nominal capital is £1,250,000, equally divided into 7 per cent. cumulative preference and ordinary shares of £1 each. The first directors of the new company are :—

Arthur Chamberlain (chairman), director of Tubes, Ltd.
James Rollason (deputy-chairman), director of Tubes.
J. Herbert Aston, chairman and managing director of Tubes and director of Credenda Conduits.
C. T. Barlow, joint managing director of Accles & Pollock.
James Kemnal, managing director of Babcock & Wilcox.
T. Pollock, chairman of Accles & Pollock.
L. M. Waterhouse, managing director of Simplex Conduits.

The directors of Simplex Conduits state that negotiations between the companies have been conducted on a broad basis. Due weight has been given to pre-war and war conditions and to the post-war prospects of each company.

Arrangements have been made with Tube Investments authorising the directors of Simplex Conduits to pay an interim dividend of £2 5s. 2d. per cent., free of tax, on the ordinary shares of Simplex Conduits for the 12 months ended July 31st, 1919. A bonus of £2 8s. per cent., less tax, will be paid on the preference shares. It is not anticipated that any further distribution will be made for the above period.

The Prospects of Japanese Competition.—Our contemporary, the *Engineer*, quotes the following concluding remarks from an address to the London Chamber of Commerce by Mr. E. F. Crowe, Commercial Counsellor to his Britannic Majesty's Embassy, Japan :—

"The danger from Japanese competition is not serious, provided that we get back soon to normal conditions, and that our output is not unreasonably curtailed or profiteering allowed to go unchecked. The fact that Japanese industry is in a state of transition from the cottage to the factory must, for some time to come, affect the quality of her goods. Her labour, though plentiful, is not very efficient. Even its apparent cheapness may not perhaps continue for long, as the cost of living is rising and wages must necessarily advance. There is comparatively little research work being done, and many of the industries have not emerged from the imitative stage. Japan has practically no iron mines, and she is dependent on foreign sources for nearly all the important raw materials she requires, with the exception of silk and copper. Coal she has, but it is very expensive. Moreover, means of communication are somewhat defective, and seriously hamper the development of trade and industry on a large scale. Against those disadvantages must be set the fact that she is able with her labour—costing, at a rough estimate, 14s. for males and 9s. 4d. for females for a 70-hour week—to turn out goods which, even though of inferior quality, are considerably cheaper than British articles; they are generally of a non-competitive nature, as they are of a different grade."

Trade Announcements.—Messrs. Norman Johnson and Co., Ltd., who, as announced in our "New Companies Registered" section last week, are doing business as manufacturing, mechanical and electrical engineers at "Hop Poles" Engineering Works, Baker Street, Enfield, are prepared to undertake the machining of any parts of machinery, electrical or otherwise, and have several machines available for the purpose. They are also undertaking the manufacture of small dynamos and standard sizes of ½ and 1 h.p. motors, and desire to receive lists from wire and insulation manufacturers.

Mr. Malcolm Breingan, late representative of the Western Electric Co. in Glasgow, has acquired the electrical supply business of Watson & Whyte, 57, Robertson Street, Glasgow, and he will continue it under his own name.

LIGHTING AND POWER NOTES.

Aberdeen.—Price Increase.—The price of electricity for power purposes has been increased by an additional 25 per cent. upon present charges.

Altrincham.—Price Increase.—The price of electricity for domestic heating and for power is to be increased by a further 20 per cent., and the charges for hire of motors by 50 per cent.

Australia.—N.S.W.—The Corowa Municipal Council has been advised by Mr. W. Corin, electrical expert to the Government, in regard to the extension of electricity supply, to either obtain a bulk supply from Albury, 35 miles distant, or to await the erection of the Victorian Electricity Commission's hydro-electric works on the Mitta Mitta. To connect Corowa with the Albury system it is estimated would cost £500 per mile.

MACLEAN.—The Municipal Council has accepted the offer of the Maclean Dairy Co. to light the town by electricity.

Belfast.—PRICE INCREASE.—The present charges for electricity are to be raised by 7½ per cent. all round, as and from the beginning of the next quarter.

Bingley.—LOAN APPLICATION.—Application is to be made to borrow £2,000 to cover the cost of laying a supply cable from Bingley to Crosaflatts. An application for electricity for power purposes has been made to the Council by a firm which is about to erect new industrial works in that district.

Blackburn.—NEW GENERATING STATION.—Work was begun, last week, upon the new electricity station, and it is intended to push on the work with all speed.

The profit made on the production of munitions at the electricity works during the war was £23,864. The information given under "Blackpool" last week related to Blackburn.

Blackpool.—STRIKE.—Employés at the electricity works are out on strike for improved terms. The trouble primarily centres round the question of 12½ per cent. on wages allowed to certain workers on munitions during the war. The Electricity Committee holds that it is under no obligation to recognise the claim, which the men hold should be retrospective over a long period. The men not receiving the 12½ per cent. have been granted a payment in lieu of it, the difference between their pay in this form and the 12½ per cent. being about 1s. 5d. per week.

Bradford.—PRICE INCREASE.—The charges for electricity have been advanced, as from July 1st, as follows:—Accounts of all classes of consumers not subject to re-adjustment in accordance with the price of coal, increased by an amount which will make, with the 20 per cent. added on April 1st, a total increase of 50 per cent. over pre-war rates; all bulk supply and consumers using energy for motive power, including those having long-term contracts, will continue to pay, in addition to the existing basic rates, 0·015d. per unit for every 6d., or portion of 6d., for ton increase in the price of coal delivered at the Valley Road electricity works over and above 9s. per ton, as hitherto.

Burton-on-Trent.—LOAN SANCTION.—The E.C. has obtained sanction to borrow £7,500 for mains, and £6,000 for services and transformers, the periods allowed for repayment being 25 years and 15 years respectively.

Buxton.—PRICE INCREASE.—The price of electricity will be increased from 6d. to 8d. per unit for lighting and from 3d. to 3½d. for power up to 10,000 units, at the end of this month.

Canada.—WATER POWER.—The Winnipeg River Power Co. has commenced the construction of a big power plant at Lac du Bonnet Falls, 75 miles north-east of Winnipeg. The ultimate capacity will be six units of 28,000 H.P. each, or 168,000 H.P., and the project, which will be completed in three years, will cost £1,400,000. The capacity of the new plant will exceed the combined present power output of the city's plant at Point Dubois and that of the Pinawa Channel.

Continental.—FRANCE.—The Under-Secretary for Public Works proposes that France should use the Rhône and other rapid-flowing steams of Central France for the production and distribution of 750,000 H.P. of electrical energy. A national hydraulic trust will be formed, the shares being taken by Paris, the departments concerned, and the State. The nominal capital will be £8,000,000, and there will be an issue of £80,000,000 of bonds, guaranteed by the State.

SPAIN.—A concession has recently been granted for the establishment of plant to utilise the water-power of the River Munilla near Hoz de Arreba to generate electricity.

Epsom.—STRIKE.—At 11 p.m. on Thursday night, last week, the employés of the electricity undertaking went on strike, in consequence of the dismissal of one of their number on the ground that there is not sufficient work for all the men to do. The man contends that his appointment was a permanent one. Through the energy of the engineer, his assistant, and other officials, the supply was maintained until shortly before 9 p.m. on Friday last, when it was discovered that some one had disconnected the town's main feeder boxes. It transpired that the keys of the feeder boxes had not been given up by some of the men on strike. After an hour the supply was resumed, and measures are being taken to prevent a repetition of the occurrence.

Farnham.—MAINS EXTENSIONS.—The Slough and Datchet E.S. Co. contemplates extending the mains to Farnham Common, Farnham Royal, and Stoke Poges.

Hastings.—PRICE INCREASE.—The T.C. is to increase, from September, the charge for energy by another 30 per cent., making a total war advance of 50 per cent.

Heywood.—PRICE INCREASE.—The Corporation is to increase the price of electricity by 20 per cent.

Holmfirth.—PROPOSED PRICE INCREASE.—The U.D.C. has applied to the B. of T. for power to raise the maximum price of electricity from 6d. to 10d. per unit.

Huddersfield.—PRICE INCREASE.—The Corporation is to increase the price of electricity to all ordinary lighting and power consumers from 75 per cent. to 100 per cent. above pre-war charges.

Leeds.—RESTRICTIONS REMOVED.—The restrictions on the use of electricity, imposed during a holiday period with a view to economising coal, in view of the strike shortage, were removed for all purposes on Saturday.

Lincoln.—PRICE INCREASE.—Electricity charges have been increased by 20 per cent., as from the reading of the meters for the Michaelmas quarter.

Lynn.—LOAN SANCTION.—Borrowing powers have been granted for £21,900 for additional electrical plant, and £2,000 for mains, but as regards £6,300 required for E.H.T. mains, the Health Ministry suggested the reconsideration of laying a very long main round by South Lynn in order to supply electricity to the shipyards at West Lynn. The Electricity Committee was now recommended to consider a cable directly across the Ouse.

Market Drayton.—STREET LIGHTING.—The U.D.C. has accepted the tender of the Market Drayton E.L. Co. to light 50 or more lamps from September 1st, 1919, to May 1st, 1920, at £3 10s. per lamp.

Navan.—TIME EXTENSION.—The B. of T. has granted the U.C. permission to enforce the E.L. Order for a further period of 12 months.

New Ross (Co. Wexford).—It is reported that the New Ross Gas and Electrical Supply Co. will not have electric lighting available before the end of September. Work on the poles and wires is expected to start immediately.

Newtownbarry (Co. Wexford).—E.L. SCHEME.—Steps have been taken for lighting the town by electricity, the scheme being estimated to cost £3,000. Guarantees have been given amounting to over £1,000.

Oldham.—PROPOSED LOAN.—The Electricity Committee has received a letter from the M.H. pointing out that there still remains unexercised borrowing powers for £2,666 and £3,870, and stating that under these circumstances it was not clear that there was any necessity for further borrowing powers. The Committee intends to carry out considerable extensions, and this was the reason for its wanting more borrowing powers.

PRICE INCREASE.—An increase in the charges for electricity by approximately 15 per cent. is recommended.

FUEL CONSUMPTION.—At a meeting of the Electricity Committee last week, Alderman Hardman said the Coal Mines Department was beginning to make returns with the object of encouraging departments to consume less coal. The latest report with reference to the Oldham station, showed that during the year ending March 31st, 1918, the fuel used per unit generated was 2·71 lb., and the thermal efficiency was 10·07, while during the year ending March 31st, 1919, the fuel used was 2·72, and the thermal efficiency 10·47. Oldham was included in "B" group of stations, and the average per unit was 3·39 lb. of fuel. Compared with that figure, Oldham's record meant a saving of ½ lb. for every unit generated. Oldham occupied seventh place in "B" group for the whole country, and for Lancashire it was placed second. With regard to the thermal efficiency, the engineer and staff were making some changes which would improve the present standard.

Portadown.—E.L. SCHEME.—The T.C. referred to a Committee a proposal by Mr. D. Chapman, for the formation of a company for the lighting of the town by electricity. The capital would be £40,000, of which £20,000 had already been promised.

Rathmines (Co. Dublin).—PRICE INCREASE.—The cost of electricity is to be raised to 8d. per unit, and notice has been given to abolish the 10s. 6d. minimum charge per quarter.

Reigate.—PRICE INCREASE.—The price of electricity has been increased by another 16⅔ per cent., making a total war increase of 50 per cent.

Richborough.—CRANE DRIVERS' WAGES.—We regret that we were wrongly informed with reference to the figures given under the above heading in our issue of the 15th inst. The present rates of pay are:—For electric and steam crane drivers, £3 8s., and for steam derrick drivers, £3 12s. per week, with, of course, overtime and Sunday pay in addition, and not as previously stated. The men, we understand, have made application for a revision of rates, but no alteration has yet been made in their present rates of pay.

Richmond-on-Thames.—PRICE INCREASE.—The E.L. and P. Co. has applied to the B. of T. for an order to increase by 30 per cent. the existing charges, viz.:—Lighting, 4½d. per unit, plus 15 per cent.; heating, 1½d., plus 20 per cent.; power, 2½d., plus 20 per cent.

Rochdale.—PRICE INCREASE.—In consequence of the increased cost of coal, &c., the Corporation is increasing the price of electricity by 10 per cent.

It was stated that the new price of 8d. per unit for lighting was the maximum charge allowed by the B. of T. The Housing Committee wished to install electric light in its new houses, but it looked as though the high prices would prohibit that being done.

Rugeley.—Prov. Order.—The U.D.C. is to apply for a prov. order for electric lighting.

Salford.—Price Increase.—Further increases in electricity charges have been agreed to; the last advances were in July. The new scale will amount to from 30 to 65 per cent. over pre-war rates for lighting, and from 50 to 90 per cent. for power and heating.

Southend-on-Sea.—Price Increase.—The T.C. has increased the charges for public lighting by electricity by 25 per cent., tramways to 3d. per unit, and for power to 1½d. for day use and to 8d. for night use.

Spenborough.—Proposed Loan.—The Electricity Committee has approved estimated expenditure of £5,465 in the laying and jointing of one E.H.T. feeder and main sub-station building and switching equipment, and is to apply for borrowing powers.

Price Increase.—An all-round increase of 15 per cent. on the net amount of consumers' accounts is to be made as from August 1st.

Stirling.—Loan Sanction.—The T.C. has received sanction to a loan of £6,500 for electricity purposes.

Stretford.—Plant Extensions.—At the E.C. there was presented a report by the consulting engineer, Mr. J. A. Robertson, upon the application of the Trafford Power Co., for the following extensions of plant, viz.:—New boilers, &c., £16,000; two rotary converters, £5,300; two feed pumps with accessories, £800; H.T. cable, £6,000. The report mentioned that these additions were occasioned by a large increased demand to existing and new consumers in Trafford Park. Whereas the average experience of other generating authorities was a fall in demand since the Armistice, at the Trafford power station there had been an increased output of 16 per cent. over the corresponding period of last year. Having regard to these demands and further developments, both within and without Trafford Park, he had considered the extension of plant necessary to meet demands for a comprehensive period of, say, three years, at an estimated capital outlay of £108,600, and that inasmuch as this had an important bearing on the electricity policy outlined in the Electricity (Supply) Bill, it was desirable to first confer with the B. of T. with a view to ascertaining its views upon the best policy of dealing with future needs of the Traffork Park area. In the meantime, such additional plant as was necessary to secure the fullest efficiency of the existing generating plant both at the Trafford power station and the Longford Bridge station should be advocated.

Torquay.—Price Increase.—The price of electricity has been advanced for lighting, power (excluding tramways), and heating, by ½d. per unit, as from next Michaelmas.

Oil Fuel Experiments.—Oil burners are to be fitted on the two latest boilers as a test, and 250 tons of oil fuel are to be purchased; as an experiment anthracite coal is to be tried.

Torrington.—Water Power.—The T.C. has approved of an E.L. scheme by a private company, which proposes to utilise the water power at the Town Mills, and anticipates supplying electricity at about half the present cost of gas—8s. 6d. per 1,000 cb. ft.

Tunbridge Wells.—Price Increase.—From September 29th the price of electricity will be increased by 2d. per unit for lighting, and by 1½d. per unit for heating and power.

Turton (Lancs.).—Price Increase.—The price of electricity for domestic and power purposes is to be increased as and from October 1st next by 50 per cent., and a minimum charge of 2s. 6d. per quarter is to operate from the same date.

Walkden.—New Sub-station.—The Lancashire E.P. Co. proposes erecting another sub-station in Brackley Street, to meet industrial and domestic demands.

Whitehaven.—Price Increase.—The T.C. has increased the cost of electricity for private lighting by 12½ per cent., a war advance of 52½ per cent., and for power by 10 per cent., making a 50 per cent. increase. There is to be a minimum quarterly charge of 7s. 6d.

Loan Application.—A loan of £5,000 for mains, services, &c., has been applied for.

Whitby.—Price Increase.—The price of electricity has been advanced for all purposes by 33⅓ per cent. from Sept. 30th.

Wigan.—Price Increase.—The T.C. has revised the tariff for electricity as under as from October 1st:—In place of the differential rate ranging from 3d. to 5d. per unit, plus 40 per cent., applied to theatres, public houses, shops, dwelling houses, and offices, a flat rate as under:—For all hours use up to 1,000 per annum of installed light 4d. per unit, plus 60 per cent.; beyond, 2d., plus 60 per cent.; heating 1d., plus 60 per cent., in lieu of 1d., plus 40 per cent.; theatres and kinemas, current used by motor generator for the projector at power rates; hire of electric motors, 1 H.P., £5 a year; 2 H.P., £6; 3 H.P., £8; 5 H.P., £10; 10 H.P., £16; 15 H.P., £20; 20 H.P., £22; 25 H.P., £24; and for special motors 20 per cent. per annum on the cost.

Wimbledon.—Proposed Price Increase.—The T.C. has applied to the B. of T. for an order to increase the charges for electricity supplied to Maldens and Coombe from 10s. and 6d. up to 20 units to 13s. 4d. and 8d. for lighting, and for power from 2d. to 3d. The Maldens U.D.C. has decided to oppose the application.

TRAMWAY AND RAILWAY NOTES.

Accrington.—Wages.—The tramway workers are making application for a further advance of 12s. 6d. per week in wages.

Australia.—Sydney.—The Works Committee of the City Council has considered a proposal by the N.S.W. tramway department to construct a tramway loop from George Street *cid* Druitt, York, and Market Streets, to George Street, in order to relieve traffic congestion. The city surveyor in recommending that permission be given, suggested that the City Council should urge the Government to proceed with the construction of the city railway.—*Tenders.*

Blackburn.—Accident.—Through the trolley of a tramcar "jumping" the wire, four people were injured. The trolley broke from its stand and fell to the road.

Continental.—France.—The first steps are being taken for the formation of an electric tramway to Saint Marcel, situated 4 kilometres from Moutiers. The former place is a large industrial centre, which is also to be served with electric lighting and power.

Derby.—Time Extension.—The B. of T. has extended the time until August 15th, 1920, of the Derby Corporation Act, 1913, for the completion of the tramways.

London.—Fare Revisions.—On September 1st a few further revisions will be made in fares on the Underground railways. This, it is stated, will conclude the adjustments in fares necessary to the scheme initiated in the spring of this year to meet the increased cost of operation.

Inquest.—At St. Pancras Coroner's Court on August 20th, an inquest was opened into the circumstances attending the deaths of the two men killed in the tramway accident on August 16th, when a car failed to take the points at a bend and overturned, falling upon A. H. J. Jackson. The wrecked car took fire, and 22 persons were injured, one man dying in hospital as a result of his injuries. A doctor described Jackson's injuries, and said there were also burns on his head, foot, and chest; the right foot was badly burned. Death was due to the injuries, and also to electric shock. A witness said the driver did his best to stop the car, he also shouted and gave warning; he stuck to his post and endeavoured to use both brakes. A second witness, who was driving a car in the opposite direction, said he saw the car travelling at about 12 to 14 M.P.H., and the driver was pulling hard at his brakes at the time. Continuing, he said the spot was not considered a dangerous one by drivers, a safe speed at which to take the curve would be about 4 M.P.H. When he examined the wrecked car, he found the magnetic brake on as far as it would go. The inquest was adjoured until yesterday.

Manchester.—Wages.—Tramway employés recently applied for an increase in their wages of 2s. per day, with the request that the war wages should be merged into regular wages. This was in reality a national demand, which, it is reported, has been refused by the Tramways Association.

Sheffield.—Extensions.—In connection with the widening of Campo Lane, in the market place, it is intended to lay tramway lines on sleepers on a 20-ft. track in the middle of the lane, with a carriage way on either side.

Collision.—Conflicting evidence was the feature in a case heard at the County Court, recently, concerning a collision between a tramcar and a motor lorry. The plaintiff, haulage contractor, sued the Corporation for £54 damages, owing to the alleged negligent driving of a tramcar on May 9th. Plaintiff's steam wagon was backing out and turning round, when the tramcar, which was going in the same direction, ran into it. His Honour Judge Adshead Elliott gave judgment for £13.

South Shields.—Proposed Light Railway.—Application is to be made to the Light Railway Commissioners for sanction to lay a light railway between South Shields and Cleadon, a distance of about 3½ miles.

Southend-on-Sea.—Loan Application.—The T.C. has applied to the B. of T. for a loan of £16,500 for the purchase of new tramcars.

Stirling.—The T.C. has abandoned the proposal to purchase the undertaking of the Stirling and Bridge of Allan Tramway Co.

Tramway Employés' Wages.—The Transport Workers' Federation some time ago made application to the two associations representing the public and privately-owned tramway systems for a 12s. increase in wages, the merging of the war bonus in permanent wages, and the reduction of the qualifying period for the payment of the maximum from seven years to six months. The employers have stated that they are willing to discuss only the question of the qualifying period. It is stated that the Ministry of Labour will not intervene.

TELEGRAPH AND TELEPHONE NOTES.

Automatic Telephones.—The automatic telephone exchange at Stockport was put in operation on the 23rd inst. The new system is on the Siemens principle, and the work of installation began in 1915, but was stopped for some time owing to the war.

Australia.—Although the restrictions on the sale of wireless telegraph apparatus and appliances imposed by the War Precautions Regulations have not been removed, the Navy Department is prepared to consider applications for permission to purchase apparatus in special cases such as for use in legitimate scientific investigation. This permission, when given, will also cover the use of the apparatus by the purchaser.

Belgium.—An agreement has been reached between the Government and the railway workers and employés of the postal, telephone, and telegraph services, whose demand for a minimum daily wage of 8 fr. has been granted, and all danger of a strike is now ended.

Greece.—The censorship on postal and telegraphic correspondence with Great Britain has been abolished, except on letters addressed to Egypt and other places where military operations are being carried on.

Germany.—It is officially announced that as from Wednesday last Press telegrams will be accepted for transmission between the United Kingdom and Germany between the hours of 6 p.m. and 9 a.m.

Hungary.—According to the *Times*, telegraphic and telephonic communication will shortly be restored between Hungary and Yugo-Slavia.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Annfield Plain.—September 12th. U.D.C. Construction of an overhead L.T. electricity distributing system. (August 22nd.)

Atherton.—September 18th. U.D.C. One boiler plate cubicle. (See this issue.)

Australia.—Sydney.—November 10th. City Council. Supply of electric motors. Particulars from Electric Lighting Department, Town Hall, Sydney.

Bramley.—Lighting installation at Working Men's Club, Elder Road, Bramley, near Leeds. The Secretary.

Edinburgh.—September 11th. T.C. Three 10,000-kw. turbo-alternators; six water-tube boilers, capacity 65,000 lb. per hour. (August 8th.)

France.—Paris.—September 12th. Chemins de Fer de l'Etat. Equipment of the sub-station of St. Cloud Parc. Two groups of converters of 120-kw. capacity. Bureaux du Service Electrique, 43, Rue de Rome, Paris.

Grimsby.—September 25th. Electricity Department. Two 1,000-kw. converters and D.C. and A.C. L.T. switchgear; E.H.T. switchgear and cubicles; coal and ash-handling plant; 30-ton electrically-driven travelling crane. (August 22nd.)

Ilford.—September 8th. U.D.C. One 500-kw. rotary converter, transformer, and switchgear. (August 22nd.)

Lincoln.—September 2nd. Corporation. One 25-ton overhead electric crane. (August 8th.)

London.—L.C.C.—September 2nd. Four electric tower wagons for the Council's tramways. (August 15th.)

Manchester.—September 2nd. Tramways Department. Tenders for supplies and general stores, including many electric items. (August 22nd.)

Merthyr Tydfil.—September 8th. B. of G. Electrical accessories for six months. Mr. F. T. James, clerk, High Street.

New Zealand.—Auckland.—City Council is calling for tenders for extensions to the generating plant, cables, &c.

Invercargill.—October 9th. One 1,000-kw., 3,300-volt, steam turbo-alternator, with condensing plant and switchgear.*

Portsmouth.—September 2nd. Tramways Committee. 12 months' supply of stores, &c., including various electrical items. (August 15th.)

September 16th. Tramways Committee. 3,200 tons steel girder tram rails, 180 tons steel fishplates, 40 tons fishbolts, 85 tons W.I. tie bars (5 ft.). (See this issue.)

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development and Intelligence), London.

Rochdale.—September 2nd. Electric lighting at the new elementary school, King's Road. Schedules from the architect's office, Town Hall.

Stockton-on-Tees.—August 30th. District Fund, Gas and Electricity Committees. Six months' supply of articles and stores. (August 15th.)

West Ham.—September 9th. Electricity Department. Lead-covered paper insulated underground cables. (August 22nd.)

CLOSED.

Government Contracts.—The following contracts were placed during July, 1919:—

(India Office, Store Department.)

Apparatus.—Elliott Bros.
Belts.—Peel-Conner Telephone Works, Ltd.
Cable.—Macintosh Cable Co.; British Insulated & Helsby Cables, Ltd.
Dynamo and motors.—Lancashire Dynamo, &c., Co., Ltd.
Fans and lamps.—General Electric Co., Ltd.
Regulators.—Veritys, Ltd.
Searchlights.—Chance Bros.
Switchboard.—Relay Automatic Telephone Co.
Testing Sets.—Evershed & Vignoles, Ltd.
Trough plates.—Dorman, Long & Co.
Wire.—Shropshire Iron Co.; British Insulated & Helsby Cables, Ltd.; F. Smith & Co.

Post Office.

Telephone apparatus.—Western Electric Co., Ltd.
Terminal blocks.—British L.M. Ericsson Manfg. Co., Ltd.
Telegraph and telephone cable.—General Electric Co., Ltd.; Hackbridge Cable Co., Ltd.; Union Cable Co., Ltd.
Leclanché cells.—Siemens Bros. & Co., Ltd.
Combiners.—Ballers, Ltd.
Compound jointing.—Dussek Bros. & Co., Ltd.
Cords for telephones.—Phœnix Telephone and Electric Works, Ltd.
Couplings and bends.—D. King & Sons, Ltd.
Cable guards.—Hewlett & Blondeau, Ltd.
Lamps for telephones.—General Electric Co., Ltd.
Glow-lamps.—B.T.H. Co., Ltd.; Edison-Swan Electric Co., Ltd.; General Electric Co., Ltd.
Manganese.—S. G. Bailey & Co., Ltd.
Stay rods.—Bayliss, Jones & Bayliss, Ltd.
Salammoniac.—Brunner, Mond & Co., Ltd.
Jointing sleeves.—Dugard Bros., Ltd.
Lead sleeves.—G. Farmiloe & Sons, Ltd.
Solder.—Quirk, Barton & Burn (St. Helens), Ltd.
Telephones.—Automatic Telephone Mfg. Co., Ltd.; Siemens Bros. & Co., Ltd.
Lead tube.—Baxendale & Co., Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; British Insulated and Helsby Cables, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co., incorporated in the London Electric Wire Co. & Smiths, Ltd.
Enamelled and silk covered copper wire.—London Electric Wire Co. & Smiths, Ltd.
Laying conduits (short lengths non-continuous).—Hornsey, &c., Kensington, &c., Camberwell, &c., Willesden, &c., O. C. Summers. Fulham, Battersea, Wandsworth and Merton, Finsbury, &s., Westminster and Chelsea, Hammersmith, &c., City of London, J. A. Ewart, Ltd. St. Pancras, D. R. Paterson, Ltd. Glasgow, A. Duncan.
Laying ducts.—London-Manchester (Old Stratford-Loughborough Section II A): O. C. Summers. London-Manchester (Old Stratford-Loughborough Section II.): Kettle & Son. North Gerrard area: J. A. Ewart, Ltd. London and Manchester (London Section): W. & C. French. London and Manchester (Derby-Manchester Section I.): W. Dobson. London and Manchester (Derby-Manchester Section II.): W. Turner.
Laying ducts and pipes.—London-Manchester (Old Stratford-Loughborough Section I.): O. C. Summers. Bradford (Thornton Road): E. A. Greaves. London-Manchester (Old Stratford-Loughborough Section IV.): W. Hodge & Sons. Derby-Manchester (Section III.): W. Turner (Ardwick), Ltd. Charterhouse Exchange Junction: J. Mowlem & Co., Ltd. London-Manchester (South Lancs. Section): P. D. Hayes & Sons. London-Bristol-Newport (London District): J. A. Ewart, Ltd.
Laying ducts, troughs and pipes.—South Dalston (Section I.): J. A. Ewart, Ltd. South Dalston (Section II.): O. C. Summers. Brixton-Camberwell: J. Mowlem & Co., Ltd.
Laying ducts, pipes, troughing and Cable.—Golders Green: O. C. Summers.
Provision of hydraulic pumping plant and accumulator.—Studd Street Depôt: J. Shaw & Sons (Salford), Ltd.
Supply, drawing-in and jointing cable.—Coatbridge-Airdrie, Motherwell-Wishaw, Motherwell-Hamilton, London-Slough, Slough-Windsor: Siemens Bros. & Co., Ltd. London-Manchester (London-Old Stratford Section): Western Electric Co., Ltd. London-Manchester (Manchester-Hazel Grove Section): British Insulated & Helsby Cables, Ltd. Ormskirk-Preston: Johnson & Phillips, Ltd.
Telephone Exchange, equipment extension.—Avenue, Lincoln: Peel-Conner Telephone Works, Ltd.
Telephone Exchange equipment.—Carlisle: Siemens Bros. & Co., Ltd.

(Crown Agents for the Colonies.)

Submarine telephone cable.—W. T. Henley's Telegraph Works Co., Ltd.
Electric lift.—Smith, Major & Stevens, Ltd.
Telegraph poles.—Siemens Bros. & Co., Ltd.; Bullers, Ltd.
Telegraphic material.—Bullers, Ltd.; Siemens Bros. & Co., Ltd.
Telephones.—British L.M. Ericsson Mfg. Co., Ltd.
Telephone line material.—Bullers, Ltd.
Track circuiting apparatus.—McKenzie Holland & Westinghouse Power Signal Co., Ltd.
Copper line wire.—Elliotts Metal Co., Ltd.

(H.M. Office of Works.)

Building works.—Charterhouse Telephone Exchange completion: Galbraith Bros., Ltd.
Engineering services.—Flax Factories electric cable: British Insulated & Helsby Cables, Ltd.
Fans.—J. Keith & Blackman, Ltd.
Generator panels.—Nalder Bros. & Thompson, Ltd.
Distribution panels.—General Electric Co., Ltd.
Kilgraston House, Bridge of Earn (Perthshire), electric wiring.—Mackenzie & Moncur, Ltd.
National Physical Laboratory, Teddington, electric wiring.—Lund Bros. & Co.

Southend-on-Sea.—T.C.:—

Six large double-deck top-covered tramcars and one toast-rack car with Brush electrical equipment.—Brush Electrical Engineering Co., Ltd., £17,886.
Two pumps and two motors.—Worthington Simpson, Ltd., £1,010.

NOTES.

The Fixation of Atmospheric Nitrogen.—In the House of Commons on April 5th, 1918, Mr. Winston Churchill announced that the Ministry of Munitions was about to embark upon the fixation of nitrogen from the air on a large scale. The Nitrogen Products Committee was set up shortly after Mr. Lloyd George became Minister of Munitions. In 1917 an interim report of the Committee recommended that manufacture on a large scale should be started, and early in 1918 beginnings were made with the factory, and arrangements made for the supply of electrical power. But progress was slow, and when the Armistice was signed the whole scheme was still in the embryo stage, and no nitrates had been produced. It is reported that a million of money was sunk, but the work was stopped. It is understood that one reason for the delay in the publication of the report of the Nitrogen Products Committee is the amount of work that has been necessary in the preparation of an index. This is believed to be now nearly complete. The issue of the report is awaiting a definite instruction from the Minister of Munitions. A representative of *The Times* was informed last week that the report, which is dated May last, deals at length with the project for installing plant in Great Britain for the fixation of nitrogen from the atmosphere, and that it views as feasible the Haber, or synthetic ammonia, process. The utilisation of water power for the purpose does not take a prominent place in the recommendations. The report is a final and not an interim one, but it is believed that it contemplates the resumption of investigations into both catalytic fixation and the use of nitrogen products in industry generally.

Daylight Saving in U.S.—The repeal of the Daylight Saving Act was accomplished last week, when the Senate supported the House of Representatives by passing the repeal measure, in disregard of the President's veto.

Educational.—Although during the period of war there was no break in the continuity of Messrs. A. P. Lundberg & Sons' scheme of examinations in electric light switching, unavoidable circumstances adversely affected the pre-war regularity. Chief among these was the death of Mr. W. Perren Maycock, M.I.E.E., the popular examiner of the papers sent in. His loss was felt keenly, as the success attending the scheme since its inauguration, over six years ago, was largely due to his enthusiasm and conscientious work. A new edition of the now well-known booklet, "Lektrik Lighting Connections," was also in preparation at the time of Mr. Maycock's death, and the production was consequently delayed through the necessary revision and extension of the matter in the absence of the guiding hand. Now that Peace has been signed, the firm will be in a position to put things more on the pre-war basis, particularly now that the new and enlarged sixth edition of "Lektrik Lighting Connections" has been published. Mr. W. H. Bray, A.M.I.E.E., is Mr. Maycock's successor in the examinership. He is one of the most successful London teachers of electrical engineering and installation work under the City and Guilds of London Institute's examination schemes in this country. He was also closely associated with Mr. Perren Maycock in the preparation of his later popular text-books.

University of London, King's College.—Faculty of Engineering.—The 1919-20 terms commence on October 1st. Considerable additions have been made to the engineering department, including drawing offices, lecture rooms, lecture theatre, and rooms for research, including wireless telegraphy. Full particulars of the courses can be obtained from the Secretary. See our advertisement pages to-day.

Bradford Technical College.—Department of Mechanical Civil, and Electrical Engineering. — The new session, commences September 22nd. Diploma and part time courses are offered in the above and motor engineering, power production and transmission. For full particulars see our advertisement pages to-day.

A Defective German Submarine Cable.—The issue of August 18th of the Danish *Politiken*, of Copenhagen, reports that a breakage took place recently in the cable between Denmark and Sweden, which supplied power to the North Jutland Electricity and Tramway Co. Nevertheless, it has been possible to satisfy consumers by an increase in the production at the electricity works in Skovshoved, but this has placed a much greater demand on the latter's stocks of coal.

The Wireless Society of London.—The Committee met on July 24th, under the presidency of Mr. Alan A. Campbell-Swinton, F.R.S., with a view to an early resumption of activities. The hon. secretary, Mr. R. H. Klein, having resigned, and having being elected as acting vice-president, Mr. Leslie McMichael, of 30, West End Lane, West Hampstead, N.W. 6, has been elected hon. secretary, and to him all communications should be addressed. Intending new members and those pre-war members who have changed their address are requested to communicate with the hon. secretary.

The Society is open to all who are interested in the study and furtherance of wireless telegraphy, amateur or professional; it is at present in communication with the Post Office on the subject of licences. The finding of new club rooms is engaging the attention of the Committee, and it is hoped to secure premises where the wireless equipment of the Society can be installed and used.

A general meeting will be held in a few weeks' time, of which due notice will appear in the Press and will be sent to members and those who anticipate becoming members.

South African Technical Societies.—The scheme for a common meeting house for technical societies in South Africa, among which the chief are the South African Institution of Engineers, the Chemical, Metallurgical and Mining Society of South Africa, and the South African Institute of Electrical Engineers, is briefly set out by Mr. P. Cazalet, member of the Committee, as follows:—"Briefly, the scheme proposed may be outlined as the joint ownership of an institute building containing offices for each individual society, as well as for the secretary and staff of the Institution itself; large and small meeting halls; reading, smoking, and refreshment rooms, with a nucleus of a good scientific library. If bedrooms for members from a distance could be included, the convenience of the Institution to such would be greatly increased; were it possible also to provide accommodation in the building in excess of the societies' first requirements, professional men might be taken as tenants of offices, thus centralising the business efforts of unattached professional men as well as those of their societies." The total membership of the societies concerned amounts to 3,860, and it is considered that a fund of £110,000 is required to carry out the scheme.

Fatalities.—An inquest was held, last week, on Thomas Hodgson (53), of Blackpool, who died from injuries received by falling from the upper deck of a Blackpool, St. Annes, and Lytham tramcar. The accident occurred when the overhead electric wire snapped, which, it is presumed, must have caught Hodgson as it fell, as no one saw him fall. James Ledbetter, the chief overhead wireman, stated that since the line was electrified 17 years ago there had been only eight snaps, which he did not think could be equalled in England. Mr. H. W. Laing, the general manager of the tramways, said the same system was in use throughout the country. A verdict of "Accidental death" was returned.

James Haddon, a caulker, employed at the shipyard at Burntisland, Fife, when at work in a tank, using a movable electric light, met his death. It is assumed that, through some misadventure, the covering of the wire was forced off, and Haddon, gripping the live wire, was killed.

Water-power Survey in Japan.—We have received from the Bureau of Electrical Exploitation, Department of Communications, Tokyo, a copy of a report on the general plan of the Japanese water-power survey, which is being carried out in order to investigate the possibilities of hydro-electric power production for industrial power purposes. The survey will extend over five years (1918-22), and will cost 830,657 yen. The survey was organised in June of last year, and comprises 22 survey parties, under five District Water-power Sections; these will study 115 river basins, select 635 power-station sites, and establish 320 gauging stations and 166 meteorological observatories, in addition to 550 existing observatories. The total power of the falls to be investigated is estimated at over 5,000,000 H.P.; the sites to be surveyed are those where more than 1,000 H.P. can be economically obtained. At present over a million H.P. is utilised for the production of electricity, and about two million H.P. has been leased for exploitation, in addition to the five million H.P. above mentioned.

Magnetic Storm.—Mr. A. L. Cortie, S.J., of Stonyhurst College Observatory, writing to the *Times* with reference to the magnetic storm on August 11th and 12th, reported in a recent issue, says that the storm was one of unusual violence, the greatest recorded by the photographic magnetographs at his observatory since September 25th, 1909. In the present instance the magnets were quiet, until a sharp westerly movement of the horizontal direction magnet, and an increase in horizontal magnetic force, at 6.50 on the morning of August 11th, heralded the beginning of the storm. It was characterised by violent and rapid oscillations in direction and force, the maximum intensity of the storm being reached between 2 p.m. and 7 p.m. on August 11th. The swings of the force magnet were so extreme that the spot of light travelled quite off the paper on the recording drum of the instrument on both sides. This means that the range of oscillation was greater than 780 magnetic force units. Some idea of this force will be obtained by comparing it with the mean range of oscillation on undisturbed days in last June, which was 44 magnetic units. In the main, the oscillations of the horizontal direction magnet coincided with those of the force magnet, though they were less violent. Their extreme range was 116 seconds of arc. Roughly the needle swung about one degree both east and west of its normal position. The mean range for quiet days in June was 10 minutes of arc. These greater swings of the needles were succeeded by a violent and rapid shivering of both magnets between the hours of 3 a.m. and 8 a.m. of August 12th. This particular phase of a magnetic storm, Mr. Cortie does not remember to have noticed as so markedly prominent before. Smaller movements followed, and the storm ceased abruptly at 7 p.m. on August 12th.

Meteorological Conference.—Arrangements have been made to hold a conference of representatives of the meteorological services of the British Dominions, in London, from Sept. 23rd to 27th. According to the *Times*, the official meteorologists of Ceylon, New Zealand, Australia, Egypt, South Africa, Canada, and India will be present. The subjects to be considered will include the meteorological arrangements for the exchange of observations by wireless at comparatively long distances; specification of observations for the surface and the upper air, with the codes for transmission; and the trade routes and the meteorological survey of the oceans by observations transmitted by wireless telegraphy from ships.

Electric Vehicle Progress.—The London County Council proposes, in view of the increasing cost of horse hire, to abolish horse-drawn tower wagons and to purchase four electric tower wagons at an estimated cost of £7,000. Two new batteries of the Edison type have been ordered by the York Corporation for the omnibuses of the tramway department. The Glasgow Tramways Committee contemplates purchasing two 5-ton electric vehicles from Electromobile (Leeds), Ltd. The Rushden Urban Council has decided on the purchase of an electric vehicle for dust collection at an estimated cost of £1,250, and authorised an application for sanction to the necessary loan. The Health Committee of the Hackney Borough Council has recommended the purchase of four electric vehicles for dust collection at an estimated cost of £7,300. It is calculated that the electric fleet will effect a saving of 1s. 10d. a ton in the collections. The Preston Corporation Cleansing Department has favourably reported on a tender for the supply of two electric vehicles at £2,664. Sanction has been received by South Shields Corporation for a loan of £1,450 in respect of the erection of a charging station for electric vehicles used for refuse collection purposes. The Sheffield Cleansing Superintendent (Mr. J. A. Priestley) has recommended the purchase of 51 more electric vehicles for refuse collection purposes, at an estimated cost of about £100,000. Six electric vehicles, one generator, and ten charging panels, he suggests, should be ordered for early delivery at an approximate expenditure of £12,000. The Finance Committee has given its approval to the outlay of £14,200 during the current year. Southgate Urban Council has applied for sanction to a loan for the purchase of electric vehicles for street cleansing purposes. The Oldham Corporation is seeking permission to borrow the necessary funds for the purchase of an electric vehicle. The Newport (Mon.) Corporation proposes to purchase electric vehicles for refuse collection purposes.—*The Electric Vehicle.*

Railway Electrification.—In a recent address to the members of the Association of British Chambers of Commerce, Major Philip Dawson, whose experience on the Brighton Railway in this respect will be remembered, referred to the extension of electric traction on railways. From his remarks we extract the following:—

The factor which limits the possibilities of electrification is the capital expenditure involved in the contact, distributing and transmission system and which will be about £5,000 per mile of single track. Interest, sinking fund and maintenance will be chargeable upon this, and this amount will have to be added to the ordinary working expenses and divided over the units of traffic per car, per ton and per passenger or train-mile. How vast this expenditure might be is shown by the fact that there are over 50,000 miles of single track in the country. It is obvious that the denser the traffic the smaller this unit charge becomes. As regards the other operating expenses, including cost of power and maintenance, other things being equal, electrical haulage generally comes out best.

An additional point made in favour of electric haulage is that, provided the generating station supplying power can be economically loaded up, electric haulage will tend towards an economy in coal consumption. The most sanguine American partisans of electrification claim a saving of over 66 per cent. in coal on this basis, which would amount to about 10,000,000 tons of coal per annum in Great Britain. Against such a saving must be set off the capital charges already referred to.

There is little doubt that in an industrial area where electric supply stations already abound, and where dense mineral, goods and passenger traffic exists, electrification will be good business, so that we may anticipate the electrification of a very large portion of our railways in such areas as Glasgow and the North-East Coast, as well as the counties of Yorkshire, Lancashire, Cheshire, Derbyshire, Staffordshire and parts of Worcestershire, Warwickshire, and South Wales.

As regards long-distance electrification, the applications in this country will be far less numerous, as coal abounds and water power is scarce, and electrification will only pay in the case of dense traffic, where the railway load will be such as to provide a good load factor for the power station. There are relatively few lines of this description to be found in this country, and by far the best example, which should serve as a model and from the results of which conclusions for less favourable conditions could be drawn, is that of the London, Brighton and South Coast Railway. This is the one line ready for electrification immediately, as practically all the calculations have been made and the plans and specifications are available; the contracts for the suburban section were let before the war but are not being proceeded with owing to the present uncertainties. The putting in hand of any other electrification would take time, as complete schemes would have to be prepared and contracts let, and there is no other long-distance line as eminently suitable for electrification as that from London to Brighton. The completion of the suburban section would naturally be followed by the electrification to Brighton, for which plans are practically completed, and which would simultaneously result in providing plentiful and relatively cheap electricity supply throughout the whole of the purely agricultural and residential districts served by the railway.

The electrification of the suburban system would demand and justify the creation of a super-station, which would comply with the recommendations of the Board of Trade Committee on electricity supply and which could be the first step in the unification of greater London electricity supply on rational and business lines.

Summarising the position as regards the future of electricity supply, the prospects are very encouraging, provided the Government and legislation assist every class of electric enterprise, whilst safeguarding the legitimate interests of the consumers.

The Three-Element Vacuum Tube.—During the war litigation over rights for the manufacture and sale of vacuum tube detectors for wireless work was suspended by common consent, and tubes for government use were made at various works, says the *T. & T. Age*. As the situation stood at the close of hostilities an attractive market was in prospect, but patent rights prevented any one manufacturer from entering the field independently. The Marconi Co. held rights covering the use of a two-element bulb, Dr. De Forest's patents protected the use of the third element, and the Moorhead laboratories in San Francisco had patented other features also essential to the commercial production of the best tubes, among these being the use of a chemical process for exhausting air. During the war the Moorhead Co. had developed manufacturing facilities rapidly and valves were being turned out for the Allied Governments at the rate of 30,000 per month. Early in May, representatives of the Marconi, De Forest, and Moorhead companies held a conference in San Francisco, and agreed that the patent rights of all three should be extended to the Moorhead Co., for which the latter should make payment to the other two on a royalty basis. This company is only permitted to make receiving and amplifying valves, the Western Electric Co. having the rights to manufacture the transmitting tubes. It was also agreed that the Marconi Co. would become the sole sales and distribution agent for the Moorhead output. The valve produced under this agreement is known as the Moorhead audion. On July 7th, Judge Mayer, in the United States District Court, New York, in the suit brought by the Marconi Co. against the De Forest Radio Telegraph and Telephone Co., handed down a decision holding that the Marconi Co.'s patents for vacuum valve devices give that company priority over the De Forest Co.

Water Power in the United States.—A private Bill was introduced into the last session of the United States Congress to provide for the development of the hydro-electric resources of the country. The Chamber of Commerce of the State of New York has forwarded a resolution to the Federal Government to adopt this Bill as a Government measure and to proceed with investigations and legislation at the earliest opportunity. The Chamber recommends a fixed national policy of conservation and development under a continuing business-like administration, and states that the essential points for consideration are:—

1. An inventory of the natural water resources of the nation.
2. A national policy for their utilisation.
3. Apportionment of income and expenditures relating thereto.
4. Continuity of plan and of administration.
5. Details and order of development.
6. Plan and estimate of cost of each complete project.

The former wasteful, inconsistent, and fluctuating expenditures under what has been known as the "rivers and harbours policy" is condemned, and the appointment of a Federal Commission, with a sufficient appropriation to provide it with a proper technical staff to carry on investigations, to plan development, and to report to Congress on the above subjects is suggested.

No accurate estimate of the total amount of hydraulic power in the United States is obtainable, but the figure probably most frequently used for all the water power in the United States is 60,000,000 H.P. The United States census in 1912 gave only 4,870,000 H.P. of the total potential hydraulic power as developed, and the report of the Secretary of Agriculture, January, 1916, estimated that the developed horse-power had been increased to six and a half millions. The Chamber of Commerce says that "legislation must be enacted free from political bias and private or corporate influence. Such legislation can be accomplished only by the nation, with the State and the individual working in harmony to produce co-ordinated statutes. . . . The policy of the expediency of the moment and the consideration of only local interests which has heretofore prevailed must be abandoned; and the new economic policy must be that of a business administration under scientific and technical direction."

The Bill promoted by the Chamber in Congress proposes to create a National Board of Water Conservation. In its general provisions it defines the powers and duties of the proposed Board, giving to it the control and jurisdiction of the Inter-State waters of the United States.—*B. of T. Journal.*

Ultra-violet Light.—In a letter to *Science* Profs. R. A. Millikan and R. A. Sawyer, of the University of Chicago, announce that they have succeeded in extending the range of the ultra-violet spectrum from the limit of frequency of 196,000 vibrations per second previously attained to 312,000 vibrations, or three-quarters of an octave, by the use of a very high vacuum and a new type of grating. They are now able to maintain a vacuum of about 10^{-4} mm. of mercury while the arc is running, and have thus brought to light a considerable number of new lines in the spectrum of zinc below 500 Angstrom units, the shortest having a wave-length of 320 units.

Wireless on Aircraft.—An article in the *Jahrbuch der drahtlosen Telegraphie und Telephonie* deals with the general principles of design of wireless apparatus for aircraft and details of the characteristics of the various organs. The limiting weight of the apparatus lies between 20 kg. for fighting one-seaters to 75 kg. for large aircraft, and the design of the aircraft itself should be developed with a due appreciation of the requirements of the wireless equipment. Various types of electric current are required on an aircraft for lighting, heating, signalling, and operating auxiliary devices, and it is necessary to design the generators so as to be adaptable for these various purposes.

The antennæ may be in the form of trailing wires, or semi-rigid, or rigid. The first two types have the drawback of limiting the flying properties of the machines, while the last-named avoid this defect at the cost of a reduced radiating power, and can only be used with undamped waves. The angle at which the antenna hangs depends only to a small extent on the speed and loading weight. Thus an increase of speed has only an inappreciable effect in reducing the strength of the signals. A 35-m. antenna loaded with 515 g. requires ½ H.P. to drag it through the air. The directive effect becomes very marked at distances of 10 km. In fact, the ratio of the strength of signals received by a ground station when the aeroplane is approaching or departing from the station is 54 to 1. The signals in a backward direction are very weak within an angle 20° on either side of the line of flight.

Wireless and Longitude.—Under the auspices of the French Bureau des Longitudes, wireless telegraphy is shortly to be applied to a longitude determination of a complete circle of the globe, says the *Westminster Gazette*. Three places have been chosen almost equidistant—Paris, Shanghai, and San Francisco—each separated from any one of the other two by approximately one-third of the earth's circumference. Accurate clocks at these places will be compared by means of wireless signals from three other places—Annapolis, Honolulu, and a French station are suggested—and as 15° of longitude are equal to an hour's time difference, the instantaneous comparison of the clocks at the three places selected for the experiment will enable the differences of longitude to be accurately calculated.

Rapid Electrolytic Copper Assay.—Nearly all apparatus for electrolytic analysis is equipped with a motor and revolving cathodes which agitate the electrolyte while the metal is being deposited, and this is an advantage. However it is possible, without such equipment, to perform this assay quickly, if precisely the proper conditions are obtained. Mr. R. G. Place, writing in *Chemical and Metallurgical Engineering*, says he found the following to be the best method of procedure, the cost of making each assay being 30 c., which figure includes cost of materials, labour, interest on cost of laboratory equipment, and depreciation.

A sample of the ore was decomposed in 5 cc. each of HNO_3 and HCl, heated nearly to dryness, and then 5 cc. of H_2SO_4 was added and heat applied until SO_3 fumes were freely evolved. The residue was cooled, diluted, 1 cc. of HNO_3 added to break up the anhydrous ferrous sulphate, boiled, cooled and filtered to remove insoluble. The filtrate was then placed under the electrodes and the copper precipitated, after which the cathode was washed in water and then in alcohol, and then burned over a free flame before weighing. The Winkler type of cathode was used, constructed of a cylinder of platinum gauze 3 cm. in diameter and 6 cm. in length. The gauze was composed of wires 0·06 mm. in diameter with 41 meshes per linear centimetre. The anode used was simply a spiral of No. 16 platinum wire hung inside the cathode. With this arrangement rapid deposition was effected and no trouble with spongy deposits was encountered. Another fact that facilitated rapid work was the quantity of solution used, and 100 cc. was found to be the minimum amount of solution that could be used without having the solution so concentrated that it would dissolve the copper faster than it was precipitated.

French Output of Iron Alloys.—The output of iron alloys in France has undergone rapid growth in late years, rising from 31,216 tons in 1904 to 64,459 tons in 1910, and 70,000 tons in 1913. In these figures, ferro-silicon stood for 15,000 tons, being exceeded only by the Scandinavian output with 17,000 tons. The production of ferro-silicon by Switzerland in 1913 was 7,000 tons, that of Austria-Hungary 2,500 tons, and of Italy 2,000 tons. From 1914 to 1918 the hydraulic power utilised in the French Alps in the manufacture of carbide and iron alloys advanced from 80,000 to 150,000 H.P.; it will total 230,000 H.P. when the works under way are finished. In addition, the Massif Central and the Pyrenees will furnish about 100,000 H.P. At the present time the Comptoir Français du Ferro-Silicium, which regulates the conditions of delivery and sale of this article, comprises ten distinct companies, of power capacities ranging from 7,000 to 23,000 H.P., and aggregating 149,200 H.P.—*L'Electricien.*

The "Sonic" System.—The *Evening News* of August 23rd tells us some more about the wonderful inventions of Mr. G. Constantinesco, the Rumanian inventor of the gear which enabled machine guns to be fired through aeroplane propellers. It is claimed that the "Sonic" system "will enable ships to be driven without cranks and shafts, machinery in factories to be put in motion without shafting, and railway coaches to be propelled under their own self-contained power without extraneous aid, such as electric trains have to use in the way of cables and 'live' rails."

It is easy to call spirits from the vasty deep—but will they come? We shall believe in these marvels when we see them, and no sooner.

Lamp-makers' Arbitration.—Arbitration was decided between Messrs. Dick, Kerr & Co., Preston, and the National Union of General Workers, on August 21st. The claim, on behalf of the women employed by the Britannia Lampworks, was for an advance of 6s. a week and a further advance of 5s. a week to women in engineering shops, boilershops, and foundries. The women concerned are engaged in the manufacture of metal-filament lamps. It was stated that the normal working week had been reduced from 50 hours to 47 hours, for which the women received such total sum as was payable for 50 hours. The Court held that the claim had not been established.

Railway Employés' Wages.—The meeting between Sir Auckland Geddes, the President of the Board of Trade, and the Negotiating Committees of the National Union of Railwaymen and the Associated Society of Locomotive Engineers and Firemen, last week, resulted in an agreement for a new post-war standard wage for the three grades of drivers, firemen, and cleaners. The new agreement becomes operative as from August 18th, but by the arrangement under which wages were stabilised for the present year, any reduction which affects an employé will be deferred until after December 31st.

The following amended offer has been made by the Government, and the Negotiating Committees of the A.S.L.E.F. and the N.U.R. have undertaken to recommend their Committees to accept it :—

Drivers and Motormen.—First and second year, 12s. per day; third and fourth, 13s.; fifth, sixth, and seventh, 14s.; eighth year and upwards, 15s. per day.

Firemen and Assistant Motormen.—First and second year, 9s. 6d. per day; third and fourth, 10s. 6d.; fifth year and upwards, 11s. per day—the above to include all war wages.

Cleaners.—16 years of age and under, 4s. per day; 17 years, 5s.; 18 and 19, 6s.; 20 years and over, 7s., plus war wages.

It has also been agreed that the settlements reached and agreed to at previous conferences on the questions of the preparation of engines, promotion from cleaner to fireman, and from fireman to engineman, and also seniority and mileage, shall come into force as on and from the 18th inst. This settlement will abolish classification and payment of work on account of class of work done, and will give to each man an automatic advance in accordance with the number of turns or shifts of duty employed as drivers or firemen. The war wages of the cleaners which are to be retained are :—18 years of age and under, 16s. 6d. per week; 18 years of age and over, 33s. per week.

Fuel Research.—According to the *Morning Post*, the erection of the Fuel Research Station at East Greenwich has been delayed by the shortage of bricks, which necessitated the substitution of a steel-framed structure; the latter could not be erected until adequate foundations had been prepared, and this work was not completed until February last. The building is now practically finished, and a large portion of the plant has been erected; a nucleus staff has been at work for some months preparing for the full-scale investigations, which will be commenced next month. The chief engineer is Engineer-Commander Shaw, whose services have been lent by the Admiralty; Prof. Thomas Gray, of the Royal Technical College, Glasgow, is chief of the laboratory and chemical staff.

Decimal Coinage.—An important public meeting will be held at the Mansion House on October 14th, 1919, at 4 p.m., the Lord Mayor presiding to discuss the subject of decimal coinage. Admission will be free, but, as the accommodation is limited, application should be made for tickets to Mr. G. E. M. Johnson, Secretary of the Decimal Association, 44, Finsbury Pavement, E.C. 2.

The Royal Commission which has been inquiring into the decimal system of coinage has completed the taking of evidence, and is now considering its report. It is understood that the report arrived at by the Commissioners is non-committal, and that no legislation is likely to result.

Appointments Vacant.—Assistant meter superintendent (£208), for the Greenock Corporation Electricity Department; plumber jointer, for the Hackney B.C. Electricity Department; mains superintendent (£5), for the Borough of Cheltenham Electricity Department; station engineer, for the Londonderry Corporation Electricity Works; train lighting inspector (340 Rs. per month), for the Madras and Southern Mahratta Railway; lecturer in electrical engineering (£250—£300), for the Aston Technical School. See our advertisement pages to-day.

Dundalk Industrial Show.—At Dundalk Industrial Show, last week, the Urban Council's electricity department made an effective display of electric heating and cooking apparatus and utensils, together with electric radiators of various sizes and makes. Special attention was paid by visitors to a hay-box oven, heated by one carbon incandescent lamp. It is hoped to popularise this class of oven for cooking in the homes of the workers, who form a great proportion of the Dundalk population, railway shops, breweries and docks providing much of the employment in this unusually prosperous Irish town.

Our Economical Government.—A correspondent tells us that he notices in an auction sale catalogue, describing Government plant for sale, an item which reads as follows: "A riveted steel chimney about 5 ft. diam., 100 ft. high, with copper lightning conductor, wrought-iron ladder, fire-brick lining and brick base." If we are to suppose that the copper lightning conductor runs to the top of the chimney, this example of Government practice certainly takes the prize. We can only hope, in the name of common sense, that the conductor referred to was the necessary connection between the base of the chimney and the earth-plate.

Electrical Progress in Madras.—The use of electricity in the Madras Presidency is becoming yearly more and more popular; the last five years have witnessed a great advance. In 1913 the number of consumers of electricity in Madras City was 1,335, with a consumption of 3,579,131 units; in 1917 the number had risen to 2,529, and the consumption to 5,942,881 units. This increased use of electricity has necessitated the complete renewal of practically the whole of the generating and sub-station plant and the erection of additional sub-stations at George Town, Kilpauk, Adyar, and Mount Road. Street lighting in Madras City shows considerable progress—there are 24 miles of street-lighting mains with over 2,400 lights—and the Corporation is using electricity for the pumping of sewage in several parts of the city. In the mofussil the increasing popularity of electricity is evidenced by the number of private plants, and by the number of applications for licences to put down plant and mains, as for example, Tenali, Madura, Trichinopoly, and Karaikudi, and possibly Bezwada. To improve the standard of wiring work, Government has instituted at the Government Trade School, Madras, classes in that subject. Further, Government proposes to grant after examination, certificates of competency to electrical wiremen. The following are excerpts from the recently published Madras P.W.D. report for 1917-18: The number of electric installations under P.W.D. maintenance throughout the presidency is 69. The capital cost is Rs.11,06,332, and the amount spent on their maintenance, apart from the actual consumption charges was Rs.55,260. The value of the more important works completed totals Rs.1,22,773. The hydroelectric scheme from the Siruvani river source is for the supply of water and electricity to Coimbatore and Podanur, and possibly electricity only to the Nilgiri Hills. Establishment has with difficulty been obtained, the investigation of the dam site and catchment basin, the gauging of the flow and other works at the site, and the water distribution schemes in Coimbatore and Podanur, are being proceeded with.

The Sri Rama E.S. Co. at Tenali received sanction to supply electrical energy in the Morrispet portion of Tenali, Guntur district, and the supply was commenced on March 21st, 1918. Messrs. Best & Co., Ltd., Madras, have applied for licences for the supply of energy within the municipal limits of the towns of Trichinopoly and Madura. The Bezwada municipality has under consideration the supply of electric light and power to the various mills and residences. It has to be decided whether the municipality should itself finance and work the undertaking or let a private company do so. A licence for the supply of electrical energy within the union limits of Karaikudi, Ramnad district, has been applied for by Mr. A. V. R. R. M. Chokkalingam Chettiyar. In connection with the electrification of the P.W. workshops an agreement to supply electrical energy has been entered into with the Madras E.S. Corporation. The manufacturing plant of the Government cinchona factory, Naduvattem, Nilgiris, is being modernised throughout, and a scheme to supply it with electric power from a neighbouring river is under consideration. Increased attention has been bestowed on the voltage of supply of the Madras E.S. Corporation. The increased demand for steel poles for overhead lines has necessitated the local manufacture of ferro-concrete poles.—*Indian Textile Journal.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.

Central Station and Tramway Officials.—It is obvious from notices that have been appearing in this column during the last few weeks that considerable unrest is prevalent amongst the engineering staff of the Yorkshire Electric Power Co., many resignations having taken place amongst the executive and supervising officials of the company. We understand from the Electrical Power Engineers' Association that the main cause of the discontent is the attitude of the management towards the staff, which attitude militates against the efficient performance of the duties of the latter. It seems that an acute position was reached early in May last, when all the members of the staff resigned their positions as a protest against the state of affairs then existing. An agreement was arrived at between the directors of the company and the Electrical Power Engineers' Association acting on behalf of the members concerned, but it is now stated that the spirit of that agreement has not been observed by the management, and that since the date of its adoption there have been two dismissals and ten resignations, nearly all of those concerned being heads of departments or their assistants, and men of long service with the company. There are generally two sides to every matter, and probably the "other side" in this case may have good reason for its attitude—whatever that attitude may be. We are entirely in ignorance as to the cause of the quarrel, but it appears to us that the disaffection has reached such a stage that, seeing the dependence of great industries upon the efficient maintenance of the supply system, the matter has become one of more than purely domestic concern.

The Doncaster Town Council, last week, appointed Mr. H. B. STOKES, electrical engineer and tramways manager to the Bexley Council, to be its electrical engineer and tramways manager at £700 a year, in succession to Mr. E. S. Rayner, who is going to Hull. Mr. Percy G. Campling, deputy engineer and manager of the Rhondda Tramways, was one of the candidates interviewed.

Mr. R. FERGUSON, boiler house engineer at the Yorkshire Electric Power Co.'s Barugh power station, has resigned, having joined the firm of Messrs. Wm. J. Ferguson, Ltd., electrical engineers and contractors, Redditch.

Mr. W. A. CHRISTIANSON, who for the past six years has been the station superintendent of the Yorkshire Electric Power Co., has resigned his position, and taken up an appointment with the B.T.H. Co. in their contract department at Rugby.

General.—After acting as chairman of the Bradford Corporation Electricity Committee since 1903, Alderman G. H. ROBINSON has decided to relinquish that position on account of increasing business responsibilities.

Captain H. J. GROVES-WEBB, A.M.I.E.E., late R.E., has just returned from France, after serving since September, 1914, and has joined Messrs. Johnson & Phillips, as assistant engineer, at their city office, 12, Union Court, Old Broad Street, E.C. Capt. Groves-Webb saw service in Gallipoli, Egypt, France, and Belgium, at first in the ranks of the R.N. Divisional Engineers, later with R.E. "Signals," while for the last year he has been in charge of extensive electrical schemes in France.

The *Times* states that Sir GLYNN WEST has been appointed vice-chairman of Sir W. G. Armstrong, Whitworth & Co.

Major KENELM W. E. EDGCUMBE, M.I.E.E., London Electrical Engineers, having been recommended for the Territorial decoration, the King has been graciously pleased to confer it upon him. Major Edgcumbe became associated with the corps as an officer in 1900, was promoted captain in 1902, and major in July, 1914.

Lieutenant and Acting-Captain H. G. WHITE, Tyne Electrical Engineers, has been restored to the establishment of that regiment, of which he was a supernumerary whilst employed at a school of instruction, and at the same time he has relinquished his acting rank.

Second Lieutenant E. S. HARMAN, Dorset Fortress Electric Engineers, has been promoted lieutenant after the usual qualifying service.

Mr. F. W. NEWTON-WELLS, late of Messrs. Siemens Bros., Dynamo Works, Ltd., has taken up the position of sales manager with Messrs. R. B. Hand & Co., Ltd., 63, High Holborn, W.C. 1.

The *Times* states that Mme. Curie, the co-discoverer of radium, has been elected Professor of Radiology at Warsaw University.

Obituary.—PROF. A. G. VERNON HARCOURT.—We regret to record the death which occurred on August 23th of Prof. A. G. Vernon Harcourt, M.A., F.R.S., the celebrated chemist. While Prof. Harcourt's life work was devoted to chemical research, as one of the Metropolitan Gas Referees, he exercised considerable influence on the applied chemistry of gas manufacture, and his invention of the "Vernon Harcourt Pentane lamp" was of immense importance not only to the gas-lighting but also to the electric-lighting industry, in that it substituted for the primitive and unreliable candle a standard of illumination capable of attaining to a high degree of accuracy in the hands of an expert, and thus he contributed very materially to the development of the electric lamp.

LORD RATHMORE.—The death has occurred, at the age of 81 years, of Lord Rathmore, who filled a prominent part in Irish politics many years ago. He was a director of the L. & N.W. Railway and the N.L. Railway, and according to the *Times*, took an active part in the starting of the Central London Railway.

Will.—The late Mr. W. M. MURPHY, of Dublin, left £264,004 personal.

NEW COMPANIES REGISTERED.

Ralph Tourne, Ltd. (157,971).—Private company. Registered August 15th. Capital, £3,000 in 2,800 pref. shares of £1 each and 4,000 ord. shares of 1s. each. To carry on the business of electricians, electrical and general engineers, &c., and to adopt an agreement with R. Tourne and H. Green. The subscribers (each with one pref. share) are: R. C. Howley, 96, Twickenham Road, Leytonstone, Essex, clerk; A. T. Filer, 50, Riverway, Palmers Green, N.13, clerk. The subscribers are to appoint the first directors. Solicitors: Ashurst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C.

X-rays, Ltd. (158,010).—Private company. Registered August 16th. Capital, £25,000 in £1 shares. To carry on the business of manufacturers of and dealers in electrical apparatus and other things applicable to X-rays, &c. The subscribers (each with one share) are: C. E. Graveley, 10, Balham Park Road, S.W.12, solicitor; Mrs. F. E. Graveley, 10, Balham Park Road, S.W.12. Table "A" mainly applies. Registered office: 10, Balham Park Road, S.W.12.

British Electrical & Engineering Co. of China, Ltd. (158,044).—Private company. Registered August 19th. Capital, £50,000 in £1 shares. Objects: To carry on in China or elsewhere the business of commission, commercial and general agents, contractors, merchants, importers, exporters, manufacturers, ironfounders, and electrical and general engineers, to make advances upon or otherwise deal in machinery, implements, rolling stock, and hardware, &c. The subscribers (each with one share) are: A. E. Salmon, 13-14, Bloomfield Street, E.C., company secretary; Brig.-General C. H. Whittington, Queen Anne's Chambers, S.W. The subscribers are to appoint the first directors. Solicitors: Linklater & Co., 2, Bond Court, Walbrook, E.C.

Attenborough & Turpin, Ltd. (158,083).—Private company. Registered August 20th. Capital, £2,000 in £1 shares. To carry on the business of electrical and mechanical engineers, &c. The subscribers (each with one share) are: W. Attenborough, 20, Harrington Drive, Nottingham, electrical engineer; A. E. Turpin, 3, Gedling Drive, Nottingham, electrical engineer. The first directors are: W. Attenborough and A. E. Turpin (both permanent). Registered office: 5, Goldsmith Street, Nottingham.

Alton Battery Co., Ltd. (158,082).—Private company. Registered August 20th. Capital, £20,000 in £1 shares (7,500 pref.). To acquire freehold factory premises at Alton, Hants, from J. W. Williams and C. C. Rattey, and to carry on the business of mechanical and electrical or automobile engineers, &c. The subscribers (each with one share) are: J. W. Williams, Summercourt, Gidea Park, Essex, engineer; C. C. Rattey, 4, Parliament Hill Mansions, Lissenden Gardens, N.W.5, engineer. Directors: J. W. Williams and C. C. Rattey (both permanent). Qualification £250. Solicitors: Rexworthy, Barnard & Bonser, 90-91, Queen Street, E.C. 4.

Norwegian Electric Smelting Co., Ltd. (158,138).—Private company. Registered August 21st. Capital, £30,000 in £1 shares. To carry on the business indicated by the title, and to enter into an agreement with G. J. Stock. The subscribers (each with one share) are: J. W. Lewis, "Solva," Guiseley, Yorks, iron merchant; H. H. Blackburn, 24, Bank Street, Bradford, C.A. The first directors are G. R. T. Taylor, T. V. Miles, G. J. Stock, and H. H. Blackburn. Secretary, H. H. Blackburn. Registered office: 24, Bank Street, Bradford.

Delta Electrical and General Engineering Co., Ltd. (158,161).—Private company. Registered August 22nd. Capital, £1,000 in £5 shares. To carry on the business indicated by the title. The subscribers (each with one share) are: F. Kenyon, 20, Beaufort Street, Rochdale, grocery manager; T. Prior, 156, Shawclough, Rochdale, mechanic. The subscribers are to appoint the first directors. Secretary: T. Prior. Registered office: Kilnholme Hill, Stacksteads, Bacup.

Pettigrew & Merriman, Ltd. (158,178).—Private company. Registered August 22nd. Capital, £20,500 in £1 shares (10,000 8 per cent. cumulative preference ordinary and 10,500 ordinary). Objects: To carry on the business of mechanical and electrical engineers, instrument makers, electricians, suppliers of equipment for heat, light, sound and power, &c. The subscribers (each with one share) are: T. Pettigrew, 31, Little Heath, Charlton, S.E.7, electrical engineer; E. Merriman, 73, Elliscombe Road, Charlton, S.E.7, electrical engineer. The first directors are: T. Pettigrew, E. Merriman and P. H. Mackintosh. Solicitors: G. E. Rigden, 33, Chancery Lane, W.C.

Cuthbert Jones, Curtis & Co., Ltd. (158,159).—Private company. Registered August 22nd. Capital, £5,000 in £1 shares. Objects: To take over the business carried on by C. Jones and J. Curtis, as power engineers and contractors, at 2, Mount Street, Manchester, as "Cuthbert Jones, Curtis & Co." The subscribers (each with one share) are: J. Curtis, 56, Manchester Road, Irlams-o'-th'-Heights, power engineer; Cuthbert Jones, Thorpe Cottage, Nelstrop Road, Heaton Chapel, power engineer. The first directors are: Cuthbert Jones, J. Curtis, J. W. Baron and J. T. Parker. Solicitor: J. A. Hudson, The Bulls, Rochdale.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Aluminium Corporation, Ltd.—£50,000 debenture registered July 9th, 1919, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: K. M. Clark, 4, Broad Street Place, E.C.

Brotherton Tubes and Conduits, Ltd.—£15,000 debentures charged on the company's undertaking and property, present and future, including uncalled capital, registered July 9th, 1919.

C. F. Casella & Co., Ltd. (106,869).—Capital, £17,000 in 15,000 ordinary shares and 2,000 preferred shares of £1 each. Return dated January 1st, 1919. 12,240 ordinary and 2,000 preferred shares taken up. £3,504 paid. £10,700 considered as paid. Mortgages and charges, £2,150.

Calcutta Electric Supply Corporation, Ltd. (50,882).—Capital, £1,500,000 in 150,000 ordinary shares and 150,000 preferred shares of £5 each. Return dated June 11th, 1919. 110,000 ordinary shares and 110,000 preferred shares taken up. £1,100,000 paid. Mortgages and charges, nil.

CITY NOTES.

Brown, Boveri & Co.

The report of the directors of Brown, Boveri & Co., of Baden, Switzerland, dealing with the year 1918-19, states that export orders at remunerative prices were received to an adequate extent. However a not inconsiderable depreciation of the large stocks and of some of the partly finished and fully manufactured articles was brought about by a fairly sudden fall in the prices of materials. The manufacturing branches remained without change; sale prices continued exceptionally high, and a rapid decline was not to be expected. Despite the fall in the prices of certain materials, prices were still very high; and the increases in salaries and wages in the Swiss works led to these expenses rising by more than 100 per cent., which was simultaneous with a considerable reduction in the production. After setting aside £65,000 for depreciation of machinery, plant, &c., and £76,000 for the depreciation of shares and other investments, as compared with £65,000 and £71,000 respectively in 1917-18, the accounts show net profits and balance forward of £164,000, as against £175,000 in the preceding year. It is proposed to pay a dividend of 9 per cent. on the share capital of £1,440,000, being the same rate as in 1917-18.

Tyneside Tramways & Tramroads Co.—For the half-year ended June, 1919, the surplus of receipts over expenses was £6,943, plus £2,295 brougnt forward. Debenture and loan interest, &c., absorb £1,051; 5 per cent. dividend, less tax, on the preference shares, £601; 5 per cent. dividend, less tax, on the ordinary, £3,347; reserve for renewals, depreciation, and contingencies, £2,500; carried forward, £1,758. The traffic receipts increased by £2,388, as compared with the corresponding half of 1918. £1,500 has been charged against special reserve account in respect of increased cost of maintenance.

North Melbourne Electric Tramways & Lighting Co., Ltd.—The report for the year ended September 30th, 1918, states that the gross receipts show an increase from £39,361 to £44,203. The expenses increased from £30,429 to £33,825, due mainly to the increase in wages and cost of materials. The net revenue was £10,379, as compared with £8,932. Passengers carried numbered 3,542,052, against 3,455,011; car miles run, 472,903, against 482,461; consumers connected, 2,626, against 2,333; units sold, 844,490, against 647,546. The company has entered into a contract with the local authorities for the public lighting of Flemington and Kensington, and the necessary installation is being proceeded with.

Stock Exchange Notice.—Application has been made to the Committee to allow the following to be officially quoted:—

General Electric Co., Ltd.—25,000 ordinary shares of £1 each, fully-paid (Nos. 1,200,001 to 1,225,000; and 155,790 6½ per cent. cumulative preference shares of £1 each, fully-paid (Nos. 1,500,001 to 1,655,790).

Canadian General Electric Co., Ltd.—Dividend of 2 per cent. for three months to September 30th, on the common stock and 3½ per cent. for the half-year on the 7 per cent. preference stock.

Clarke, Chapman & Co., Ltd.—Interim dividend of 5 per cent. (1s. per share), less tax, on the ordinary shares.

Waste Heat & Gas Electrical Generating Stations, Ltd.—Interim dividend of 2½ per cent., less tax, for the half-year.

STOCKS AND SHARES.

Tuesday Evening.

Labour conditions are not worrying the Stock Exchange to anything like the same extent as they did even a month ago. The centre of apprehension has therefore shifted, and at the present time it dwells alternately upon the foreign rate of exchange, and the prospect of what may happen under the new régime of free imports. It must be confessed that the markets are none too happy. Increased income-tax or a possible levy upon capital are now subjects for open discussion, and great disappointment is felt at the absence of any kind of official lead being given towards curtailment of national expenditure at the rate of four millions per diem. The charge of prodigality is only too well founded, but it would be appropriate if those who made it were to give stronger indications of repentance than are apparent so far.

The industrial world is prepared for unexpected developments when the withdrawal of restriction of imports gets into working order. How it will affect many trading companies is declared to be an impossibility to say. It is the same with the action of the Profiteering Bill. Meanwhile, prices are left much the same as before. Buying of Westinghouse preference has added a further 5s. to the advance of 7s. 6d. last week. Whence the support comes is a matter arousing keen conjecture: the market falls back upon the buying-for-control theory. Siemens are now quoted as £1 shares, and at 1 9-32 show little alteration from the 6⅜ at which the shares stood before the division. Edison Swan 5 per cent. first debenture has gained 2 points at 81½. The market for cable-companies' shares is unsteady.

There is, as stated last week, a noticeable revival of the demand for investments upon which the dividends are paid without deduction of tax. The 4 per cent. tax-compounded War Loan is the principal example, but Globe Telegraph ordinary has hardened to 15½ and the Eastern-Western group is firm. Anglo-American deferred rallied to 22½; the dividend on this stock is paid, of course, less tax.

Amongst the manufacturing shares quoted in our lists whose proprietors receive their dividends net are General Electric ordinary, India-Rubber, Siemens and Telegraph Constructions. It may not be superfluous to point out that the fact of a dividend being paid tax-free does not preclude the right of the tax being reclaimed by shareholders who are entitled to relief from the full rate paid to the Income-tax Commissioners by the company. The top half of the dividend is accepted by Somerset House as a voucher in the ordinary way, and the calculation, with income-tax at 6s. in the £1, is not difficult.

Metropolitan Consolidated and Districts are both down at 24 and 21½ respectively. Home Railways continue in melting mood, and the settlement of the threatened strike last week has left the investor cold to what attractions may lurk in these stocks.

Hot-air is more than ever in evidence in regard to Mexico and American intervention. It has no inspiring effect upon the prices of Mexican stocks, which are weak as water. Brazilian Tractions have given way to 58¼. Held largely in Belgium, the shares have been coming to London market

under the Treasury's permission for the import of securities, and the talk of resumption of dividends is silent for the time being. Anglo-Argentine Tramways first preference have gone back to £3. British Columbia Electric preference picked up to 57, but the deferred stock is 2 lower.

It is seriously stated that there is a good demand for London Electric Lighting shares. If so, the buyers must be wanting to get in at levels lower than the current quotations, for there is nothing in the share-list of prices to reflect eagerness on the part of purchasers. Chelseas have slipped back to 3 and Kensingtons to 5. County of London ordinary and preference are both ¼ down. So are Metropolitan preference. Assurance is expressed that the Government Bill may turn out to be an excellent thing for the companies. Reference to the yields obtainable upon the ordinary shares will show that returns ranging from 5 to 9 per cent. can be obtained. The bold investor who mixes the best-class electricity supply ordinary shares may easily see that capital appreciation which to many people nowadays is of more account than dividends. For on dividends there is tax to pay.

Chadburn's Ship Telegraphs are easier at 22s. 6d., the chairman's speech on Monday being couched in cautious vein. Marconis are heavy, speculative interest having evaporated for the moment. Marines are a trifle under 3, Americans 27s. 9d., and Canadians 15s. 6d. Engineering shares keep steady, and Vickers have appreciated. Rubber shares are a good market, the material hardening to just over a florin per lb. German houses are said to be inquiring for the produce, and the condition of the New York exchange renders American purchases of rubber at least likely. The utility stocks and shares of American-Canadian undertakings are mostly quoted a dollar or two lower than last week.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1917.	Dividend 1918.	Price Aug. 26, 1919.	Rise or fall.	Yield p.c.
Home Electricity Companies					
Brompton Ordinary	10	8	6½	—	£6 10 6
Charing Cross Ordinary	4	4	9⅜	—	7 5 6
do. do. 4½ Pref.	4½	4½	8⅜	—	7 4 0
Chelsea	5	5	5	— ¼	5 0 0
City of London	8	8	11½	—	7 4 8
do. do. 6 per cent. Pref.	6	6	9⅞	—	6 3 1
County of London	7	7	9⅝	— ⅛	7 5 5
do. do. 6 per cent. Pref.	6	6	9⅜	— ¼	6 4 8
Kensington Ordinary	7	6	5	— ¼	6 0 0
London Electric	Nil	Nil	1½	—	Nil
do. do. 6 per cent. Pref.	5	5	5⅜	— ¼	8 5 6
Metropolitan	4	5	2⅞	—	9 1 10
do. 4½ per cent. Pref.	4½	4½	8⅛	—	7 1 2
St. James' and Pall Mall	9	10	6½	—	8 0 0
South London	5	5	2⅛	—	7 5 6
South Metropolitan Pref.	7	7	20/8	—	6 16 7
Westminster Ordinary	9	8	5½	—	7 12 5
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	9½	—	6 7 8
do. Def.	1½	83/6	22½	+ ½	7 12 0
Chile Telephone	8	8	6⅞	—	5 18 6
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	8	8	15⅞	—	*5 5 0
Eastern Tel. Ord.	8	8	159/8	—	*5 0 4
Globe Tel. and T. Ord.	7	8	15⅞	+ ½	*5 5 0
do. Pref.	6	6	10⅝	—	5 18 6
Great Northern Tel.	22	22	29⅝	—	7 14 5
Indo-European	13	13	61½	—	6 6 8
Marconi	20	25	5⅞	— ¼	4 11 8
Oriental Telephone Ord.	15	10	2½	—	4 9 0
United R. Plate Tel.	8	8	7½	—	*5 8 3
West India and Panama	1/8	1/8	1/16	—	*1 15 3
Western Telegraph	8	8	16½	—	*1 18 9
Home Rails.					
Central London Ord. Assented	4	4	68½	—	5 6 0
Metropolitan	1	1½	34	— ½	5 2 0
do. District	Nil	Nil	21½	—1	Nil
Underground Electric Ordinary	Nil	Nil	8⅜	—	Nil
do. do. "A"	Nil	Nil	9/-	—	Nil
do. do. Income	4	5	90	—	*5 4 3
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	5	—	6 0 0
Anglo-Arg. Trams. First Pref.	5½	Nil	3	— ¼	—
do. do. 2nd Pref.	—	—	2⅞	—	—
do. do. 5 Deb.	5	5	65	—	7 13 10
Brazil Tractions	—	—	58½	—1½	—
Bombay Electric Pref.	6	6	124	+ 3	4 18 0
British Columbia Elec. Rly. Pfce.	5	5	57	+1	8 17 0
do. do. Preferred	Nil	2½	47⅛	—	5 5 3
do. do. Deferred	Nil	Nil	40⅛	—2	Nil
do. do. Deb.	4½	4½	57	—	7 8 8
Mexico Trams 5 per cent. Bonds	Nil	Nil	57	—	Nil
do. 6 per cent. Bonds	Nil	Nil	45⅛	—	Nil
Mexican Light Common	Nil	Nil	35	—	Nil
do. Pref.	Nil	Nil	48½	—	Nil
do. 1st Bonds	Nil	Nil	68⅜	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	93	—	*1 2 9
British Aluminium Ord.	10	10	13	—	6 3 1
British Insulated Ord.	25	12½	2⅛	—	6 1 0
British Westinghouse Pref.	7½	8	3½	+ ¼	4 18 6
Callenders	25	25	9	—	6 19 0
do. 6½ Pref.	5	6½	5½	—	6 8 10
Castner-Kellner	25	20	24	—	8 0 0
Crompton Ord.	7	10	21/6	—	9 6 0
Edison-Swan, "A"	—	—	1½	—	6 0 0
do. do. 5 per cent. Deb.	4	5	81½	+2	6 2 9
Electric Construction	10	10	14	—	8 18 0
Gen. Elec. Pref.	6	6½	1	—	6 10 0
do. Ord.	10	10	2	—	*5 0 0
Henley	25	25	9½	—	8 8 0
do. 4½ Pref.	4½	4½	8½	—	6 0 0
India-Rubber	10	10	17	—	*5 17 8
Siemens Ord.	—	12	1-5/8	—	*7 17 0
Telegraph Con	20	20	28	—	*4 17 0

*Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, August 26th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/5	..
a Ammoniac Sal	per ton	£80	..
a Ammonia, Muriate (large crystal)	,,	£78	..
a Bisulphide of Carbon	,,	..	..
a Borax	,,	£39	..
a Copper Sulphate	,,	£46	..
a Potash, Chlorate	per lb.	1/1	2d. dec.
a ,, Perchlorate	,,	1/8	..
a Shellac	per cwt.	£23 10	20/- inc.
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers	,,	£28	..
a ,, Lump	,,	£16	£5 inc.
a Soda, Chlorate	per lb.	8d.	..
a ,, Crystals	per ton	£70/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
g Babbitt's Metal Ingots	per ton	£85 to £286	..
c Brass (rolled metal 4 to 1z basis)	per lb.	1/11d.	..
c ,, Tubes (solid drawn)	,,	1/0½	½d.—½d. inc.
c ,, Wire, basis	,,	1/3	½d. inc.
c Copper Tubes (solid drawn)	,,	1/7½	½d. inc.
g ,, Bars (best selected)	per ton	£146	£4 dec.
g ,, Sheet	,,	£146	£4 dec.
g ,, Rod	,,	£146	£4 dec.
d ,, (Electrolytic) Bars	,,	£125	£7 inc.
d ,, ,, Sheets	,,	£154	..
d ,, ,, Wire Rods	,,	£138	£7 inc.
d ,, ,, H.C. Wire	per lb.	1/5½	½d. inc.
f Ebonite Rod	,,	2/-	..
,, Sheet	,,	2/6	..
n German Silver Wire	,,	2/5	1d. dec.
h Gutta-percha, fine	,,	10/- to 11/-	..
h India-rubber, Para fine	,,	2/5½	..
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
f ,, Wire, galv. No. 8, F.O. qual.	,,	£42	..
g Lead, English Pig	,,	£26	..
g Mercury	per bot.	£24 to £24 10	10/- inc.
a Mica (in original cases) small	per lb.	9d. to 4/6	..
a ,, ,, ,, medium	,,	6/- to 10/-	..
a ,, ,, ,, large	,,	12/6 to 25/- up.	..
g Phosphor Bronze, plain castings	,,	1/5½ to 1/8½	..
g ,, ,, rolled bars & rods	,,	2/- to 2/4	..
g ,, ,, rolled strip & sheet	,,	2/1 to 2/6	..
d Silicium Bronze Wire	per lb.	1/9	1½d. inc.
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	,,	£268 to £269	£5 inc.
n ,, Wire, Nos. 1 to 16	per lb.	4/8	8d. inc.
White Anti-friction Metals	per ton	£84 to £286	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespears.
h Edward Tull & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

French Organisation of Production and Transmission.—

The French Government has now taken initial steps in regard to the proposed control and transmission of electrical energy under an organised system. For this purpose a Bill has been introduced in the Chamber to authorise the addition of the following article to the law of June 15th, 1906: "With the object of ensuring a more complete utilisation and a better distribution of electrical energy, whether originating in steam or hydraulic works, the State, if it does not itself take the initiative, can compel producers, and if necessary the distributors of energy, the Departments, communes, and public services in the same district, to form under its direction and in that case with its financial co-operation, a special collective organisation for the purpose of constructing and working a network of high-tension transmission lines intended specially to inter-connect the generating works and the sub-stations whence the distributing lines set out. The specification will fix the maximum tolls which the collective organisation will be able to charge to the users of the network which all producers and distributors in the district concerned can be required to utilise for the transmission of their energy. Wayleave permits cannot be granted by the prefect or concession charters given in the name of the State for this same district unless these undertakings make use of the transmission lines, and the obligations imposed upon them must in any case take into account their existence and the conditions of their working." It will be seen that producers in any district can voluntarily combine for the erection of main and common transmission lines, but in case of refusal the State can exercise compulsion on them. In addition, the State takes power to group producers and construct lines which would be handed over to the groups to work, a policy which is being followed in the regions liberated prior to and since the armistice. The question of different systems of generation, &c., does not appear to have been taken into consideration under the scheme, but possibly this will be left to the administrative authorities.

MINERAL AND GOODS TRAFFIC ELECTRICALLY OPERATED.

By THEODORE STEVENS, B.Met., E.M., M.Inst.C.E.

(*Concluded from page* 251.)

Averaging the foregoing quantities per route-mile of each electrification, the N. & W.R. has 28% more copper and double the quantity of steel strand in its transmission, 64% less copper and 25% more steel strand in its distribution than the C.M. & S.P.R. has; while the N. & W.R. handles 3·7 times as many of our so-called conditional ton-miles.

Approximate Segregations of Cost of N. & W.R. Electrification.—The N. & W.R. electrification cost was published as $3,100,000 in 1915, and later as $3,600,000,* and "the electrical installation was designed for 20 east-bound trains per day"†, but, so far as we are aware, details have not been published; we therefore make the following experimental segregations.

Any over-estimate of one item must undervalue some other, and *vice versa*. Never having seen the N. & W.R. power house, nor details of it, we will assume that it cost at least £321,000, also that a three-phase power house for equal output would have cost, on comparable basis, £290,000.

The remainder, £429,000, if subjected to the dissection on Mr. W. B. Potter's percentages, gives—

TABLE V.—N. & W.R. Costs Experimentally Segregated.‡

Conditional unit figures.		Mr. Potter's %.	Conditional totals.
£1,480 per mile	29 miles transmission. 44,000 volts. 230 British tons, conductors. 50 British tons, steel. 320 towers.	10%	£42,900
£15,800 each ...	5 sub-stations, 28,000 K.V.A.	18%	£77,000
£1,333 per mile	90 miles distribution. 210 British tons, copper. 170 „ „ steel. 1,750 supporting structures. Labour.	28%	£120,000
£180 per mile...	90 miles of track bonded.	4%	£17,100
£14,300 each ...	12 locomotives.	40%	£172,000
		100%	£429,000

These conditional unit figures are not satisfactory, *i.e.*, Mr. Potter's percentages do not apply in this case; *e.g.*, the weights of mechanical and electrical parts of locomotives have been published, and if we compare them at equal prices per ton we get the results in Table VI.

TABLE VI.—Locomotive Weights.

	C.M. & S.P.	N. & W.
Electrical part	98	101
Mechanical part	152	139
Total British tons	250	240
Electrical part at £125 ...	£12,200	£12,600
Mechanical part at £76 10s.	£11,600	£10,600
Total on this basis	£23,800§	£23,200

With these figures, graphic time-tables, input to locomotives output from each sub-station, and input to railway H.T. system have been worked out for each railway on its existing electric system.

At first glance, one looks for greater distances between sub-stations where higher voltage is collected.

When one realises that the average loss allowed in distribution with the higher voltage is about half as much as with the lower, the second glance is more inquisitive.

The minimum distance between sub-stations on the C.M. & S.P.R. 3,000-volt line is 23 miles; while it is 5 miles on the N. & W. 11,000-volt line. The average distances between sub-stations are 32 miles with the 3,000 volts, and 7 miles with the 11,000 volts.

To call attention to the essential differences in the work required in the two cases, and to the impracticability of direct comparisons, Table VIII brings side by side the train-miles, conditional ton-miles and revenue tons on these two railways.

TALE VII.—Basis Weights and Speeds.

	C.M. & S.P. System. D.C.	N. & W. 1-phase collected, 3-phase motors.	
Goods train	1 loco.	2 locos.	1 loco.	2 locos.
Loco. tons	250	500	240	480
Wagon/tare	590	590	720	720
Revenue load ...	1,660	1,660	2,200	2,200
Total tons	2,500	2,750	3,160	3,400
Trains per day, 4 each way		—	20 eastwards loaded / 20 westwards empty	
2 locos. on grades of		1·3 %	—	
Running speeds				
up ·16 % ...	28 M.P.H.	—	28	
up 1·5 %	—	17 M.P.H.	—	14
Passenger trains, 1,000 tons „ „ per day, 2 each way—				
Running speeds				
up ·16 % ...	45 M.P.H.	—	42 M.P.H.	
up 1·5 % ...	29 „	—	42 „	

TABLE VIII.—Tons, Ton-Miles, and Train-Miles.

	Route miles.	Train-miles per day.	Conditional ton-miles per day.	Tons per annum.
C.M. & S.P.R.	650			
Goods and minerals...	—	5,200	13,000,000	4,000,000
Passenger	—	3,200	3,200,000	—
N. & W.R.	29			
Goods and minerals...	—	1,180	2,710,000	13,200,000
Channel tunnel, proposed	29			
Goods	—	725	620,000	5,500,000
Passenger	—	725	290,000	—

We arrive at as reasonable a basis as possible for comparisons by redesigning each electrification for the work specified, but adopting the electric system now in use on the other railway. The efficiencies and distribution of losses found from the calculations mentioned (after Table VII) above are used.

The efficiency of generation in one-phase alternators is, say, 2·6 per cent. less than in three-phase alternators.*

The average distribution loss is about half as much on the N. & W.R. as on the C.M. & S.P.R.

It is unnecessary to repeat here the considerable details of this investigation, the results of which show that the average distance between sub-stations would be 14 miles on the C.M. & S.P.R. if the 11,000-volt, one-phase system, were used, and 13 miles between sub-stations on the N. & W. if the 3,000-volt D.C. system were used.

TABLE IX.—Distances Between Sub-Stations: Miles.

	Minimum.	Average.
One-phase, three-phase, N. & W.R., as it is ...	5	7
D.C., N. & W.R., redesigned	11	13
D.C., C.M. & S.P.R., as it is	23	32
One-phase, three-phase, C.M. & S.P.R., redesigned...	10	14

Taking the following somewhat different segregation, which claims only to be experimental, the costs of running the service specified in Table VII for N. & W.R. are compared on two systems. More accurate analyses of details could be made.

TABLE X.—Conditional Capital.

Contact wires carry 1-phase / Motors operate on ... 3-phase *Capital.*			D.C.		D.C.
Locos....	£290,000	68%	£274,000		58%
Distribution	76,000	18%	76,000		16%
Bonding	9,000	2%	9,000		2%
Step-down, ·83/K.V.A.	25,000	6	87,000	sub-stations	18
Transmission ...	29,000	7	29,000		6
		100			100
P.H. step-up... ...	15,000		11,000		
Generating plant ...	306,000		279,000		
	£750,000		£765,000		

* *Electric Railway Journal*, September 20th, 1915, page 615. *Ibid.*, February 12th, 1916, page 332.

† Messrs. Gibbs & Hill, engineers for N. & W.R. Co., *Electric Railway Journal*, June 5th, 1915, page 1059.

‡ This segregation is rejected. Compare first column of Table X.

§ The C.M. & S.P.R. Co. published in "Dawn of Electric Era in Railroading," 1917, this figure for its electric locomotive cost.

* Mr. H. M. Hobart on "Costs and Efficiencies," *Proceedings*, American Institute of Electrical Engineers, February 17th, 1912, page 159; also Dr. Miles Walker, *Journal*, Institution of Electrical Engineers, London, December 5th, 1918.

TABLE XI.—Efficiencies Assumed.

Coal bunker to drawbar	7·4%	6·9%	
Pantograph to drawbar	75*	77	Inst.C.E., Vol. CCI, p. 27.
Distribution	98·2	88	Calculated from Table VII.
Step-down	96	90	A.I.E.E., Vol. XXXI, p. 128.
Transmission	92	95·5	" " p. 129.
Step-up	96·7	97·2	" " p. 127.
Generator	94·4	97	" " p. 126.
Other P.H. plant ...	12·6	12·6	" " p. 125.
Power factor	·75	1·00	" " p. 115.
Running plant load factor, 2—10,000 kw. units running ...	·44	·48	
Generate per unit at ...	·42d.	·4d.	A.I.E.E., Vol. XXXI, p. 127.
kw.-hours at drawbar	48,000,000		

* Assumed, but on insufficient data.

TABLE XII.—Conditional Losses (in Table XI) as Percentages of Power-House Output.

Contact wires carry	1 phase	D.C.
Motors operate on	3 "	"
Step up	3%	3%
Transmission	8	4
Sub-stations	3	9
Distribution	2	10
Locomotives	21	17
Delivered to drawbars ...	63	57
	—	—
Power-house output	100	100

TABLE XIII.—Annual Expenditure—1-Phase, 3-Phase.

	Coal.	Interest, insurance, taxes, maintenance, ultimate renewal.	Wages, oil, stores.	Total annual cost.
Power house ...	£37,000	£46,000	£50,500	—
0·42d./kw.h. ...	—	—	—	—
Step-up	—	1,500	—	—
Transmission ...	—	3,500	—	—
Step-down ...	—	2,500	—	—
Distribution ...	—	9,100	—	—
Bonding ...	—	1,100	—	—
Locomotives ...	—	43,500	7,500	—
	£37,000	£107,000	£58,000	£202,000

TABLE XIV.—Annual Expenditure when Redesigned: D.C.*

	Coal.	Interest, insurance, taxes, maintenance, ultimate renewal.	Wages, oil, stores.	Total annual cost.
Power house ...	£39,000	£42,000	£60,000	—
0·4d./kw.h. ...	—	—	—	—
Step-up	—	1,100	—	—
Transmission ...	—	3,500	—	—
Sub-stations ...	—	8,700	16,500	—
Distribution ...	—	9,100	—	—
Bonding	—	1,100	—	—
Locomotives ...	—	41,000	7,500	—
	£39,000	£105,500	£84,000	£229,500

It will be seen, assuming the cost segregation in Table X, that the three-phase combination under the various conditions which have been clearly stated shows a more economical result.

Appendix.

The Proposed Channel Tunnel (for comparison). Even the "considered opinion of eminent engineers that a train ferry across the Channel was impracticable" † has not withstood the test of time, for the war made Channel ferries realities, and will, doubtless, modify another earlier opinion, which, incidentally, distinctly anticipated the success of such ferries, viz. :—

"Eight schemes for tunnels beneath the Channel, seven schemes for tubes on its bed, seven schemes for ferries, and three for bridges, all abortive, and whether viewed from a national, industrial, or speculative standpoint, such will, doubtless, continue to be the history of the question involved in the dreams of inventors and financiers—at least, as regards tunnels, tubes and bridges." ‡

We anticipate that the Channel will be tunnelled, and for comparison with the C.M. & S.P.R. and N. & W.R. electrifications, some details are added. The gradients proposed are included in Table III, from which it will be noted that the C.M. & S.P.R. has an average of 2·2 per cent. for 20 consecutive miles, nearly the distance from Dover to Calais, and ·4 per cent. heavier than the two miles of 1·8 per cent. contemplated in the Channel tunnel.

Mr. Albert Sartiaux, general manager, Chemin de Fer du Nord, anticipated* 50 trains a day, passenger trains of 400 tons, and goods trains of 800 to 900 tons.†

"40,000 kw. is sufficient for trains, pumping, and lighting,"‡ and a total cost of £16,000,000, or "less than two days' war expenditure by the Allies."§

At the Inter-Allied Parliamentary Commercial Conference, Sir Arthur Fell restated estimated and proposed service.**

TABLE XV.—Channel Tunnel.

Intervals between trains ...	5 or 10 minutes.	
Workings hours per day ...	20	
Maximum passengers per day ...	30,000 each way.	
Average passengers per day ...	2,140 each way.	
Average goods per day... ...	2,575 tons.	
Gross revenue 9·6 % of capital, made up from passengers ...	£780,000	51 %
From goods	640,000	42 %
From luggage	78,000	5 %
From mails	40,000	2 %
	£1,538,000	100 %

Sir John A. F. Aspinall, in his presidential address (1918) to the Institution of Civil Engineers, detailed the limitations of British railway structure gauge, which, until altered, would prevent Continental rolling stock passing freely over British railways.

The loading gauge of all Continental railways, except Russia's, is at least 10 in. higher and 14 in. wider than ours, which will also necessitate widening our 6-foot way.‖

THE FARADAY SOCIETY.

Measuring Magnetic Hardness Electrically.

A paper read by Mr. L. A. Wild before the July meeting of the Faraday Society described a new method of measuring magnetic hardness, and showed how this quantity was also a measure of mechanical hardness, and could thus be utilised in carrying out experimental work on thermal treatment.

Magnetic hardness is defined as the coercive force, that is, the demagnetising force just sufficient to wipe out the residual flux remaining after the current required to magnetise to saturation has been cut off. This force has a constant value for any particular specimen of iron or steel.

In the usual method of carrying out these measurements a ring specimen has been employed, but this has many disadvantages, and Mr. Wild, therefore, makes use of specimens of rod 0.5 in. in diameter and 3 in. long. The specimen is slipped into a standard magnetising coil, and its ends united by a yoke. The magnetising current having been applied for a fraction of a second, the yoke is lifted off, and the demagnetising effect of the poles removes most of the residual magnetism. What remains, however, is shown to be proportional to the coercive force, and this is measured by inserting the rod specimen in a specially designed ballistic coil, 0.5 in. long and 1 in. in diameter. The throw of a ballistic galvanometer in circuit on withdrawing the rod gives a direct reading of the magnetic hardness. The method is obviously one of extreme simplicity. It takes only two minutes to make a test, and the results obtained are declared to be reliable and consistent.

Many heat-treatment experiments were described in which the method was utilised. In these an electrically-heated salt bath furnace and tempering furnace were employed. In one series it was shown how tempering iron at 215 deg. C. hardens it considerably, while refining (heating to the AC, point and quenching) has a much less hardening effect. Mild steel, on the other hand, is still further hardened by refining, while in high-carbon steels no effect of hardening on maturing after annealing has been observed.

Another series of experiments showed at a glance the effect of various quenching mediums on different varieties of steel, and they were indicative of the value of the method in carrying out researches of this kind, so necessary to enable full

* Wages, oil, stores in D.C. sub-stations ·05d./kw.h., as on West Jersey and Seashore Railway, A.I.E.E., Vol. XXX, p. 1384; Vol. XXXI, p. 117, on "Locomotives." 3·6d./loco.-mile, allowing 40 per cent. shunting and light mileage, Inst.C.E., Vol. CCI, p. 165.

Interest, &c. :—10 per cent. on sub-stations and transformers, 12 per cent. on transmission and distribution, 15 per cent. on power house and locomotives.

† Quotation from Mr. W. T. Perkin's letter in *Yorkshire Observer*, May 2nd, 1914, reprinted January, 1917, in "The Channel Tunnel and the World War," page 121.

‡ The *Engineer*, March 22nd, 1907, page 281.

* *Electrical Times*, p. 403, December 6th, 1917.

† Average goods trains, C.M. & S.P.R., 2,500 tons. Average goods trains, N. & W.R., 3,400 tons.

‡ "The Channel Tunnel and the World War," p. 160.

§ *Ibid.* p. 184.

** *Daily Chronicle*, July 5th, 1918.

‖ *Evening Standard*, page 7, October 12th, 1918.

advantage to be taken of the characteristic qualities of the numerous ferro-alloys now at the disposal of engineers.

If, as it seems, the author's claim that magnetic hardness is a measure of mechanical hardness—of some kinds if not of all kinds—can be sustained, his method should be one of very great value to the metallurgist and engineer. It has the advantage at once over the Brinell or scleroscope methods in their most obvious defects, in that it measures the hardness of the whole mass of the material, and not only that of selected spots on the surface. This in many instances may be of considerable importance, while for the more routine work of testing quenching fluids or working out best methods of heat-treatment, the method should be of considerable utility in the foundry and workshop.

The Disappearing Filament Type of Optical Pyrometer.

A paper extremely useful to men engaged on high-temperature measurements was contributed to the meeting by Mr. W. E. Forsythe, of the Nela Research Laboratory, U.S.A. Dr. Ezer Griffiths, of the National Physical Laboratory, took charge of the paper. The pyrometer, the principles and use of which were described, is one extensively used in America both for research and in industry, but it is not well known over here, so it is well that physicists should have an opportunity of understanding its features and merits.

The pyrometer is very simple in construction. It is substantially a telescope with a lamp filament—the comparison source—at the focus of the objective. In series with this lamp is a small battery, a resistance and an ammeter. To measure the temperature of any hot body the instrument is first sighted upon the hot body. This sighting is done just as easily and in much the same manner as one sights an opera glass. When looked at, the hot object is seen with the pyrometer lamp filament crossing it, and if a sufficiently large current is passed through the pyrometer filament it will appear brighter than the background, but if not enough current is sent through the filament, the source sighted upon will be the brighter. If the current through the pyrometer filament is properly adjusted, by changing the resistance in series with the lamp filament, the latter can be made to appear just as bright as the source that is sighted upon.

To make it easier to tell when the pyrometer filament is at the same brightness as the object sighted upon, a red glass is mounted in the eyepiece. With a good red glass in the eyepiece, all trouble due to a colour difference between the source being investigated and the pyrometer filament is eliminated. If the pyrometer has been previously calibrated, the temperature of the object sighted can at once be determined, and to calibrate it, it is only necessary to determine the current through the lamp when the pyrometer is matched in brightness against a standard source at a known temperature.

The paper discussed very fully the theory of the instrument and of its calibration, and also the limits of its accuracy. It suffices here to say that even with inexperienced observers good and consistent results have been obtained, and this account of the instrument, therefore, usefully fills a gap left in the survey of the field of pyrometry made by the Society nearly two years ago.

To the illuminating engineer it is of interest to note that this type of pyrometer can be calibrated to give the relative brightness of a source of light instead of its temperature, and it can also be used to measure the transmittive power of various glasses, such as lamp bulbs.

Some Chemically Reactive Alloys.

In a paper with the above title Mr. E. A. Ashcroft described the remarkable properties of some alloys of metals of the magnesium type with those of the lead type which he has observed. Thus an alloy of 15 per cent. magnesium with 85 per cent. lead will rapidly and completely oxidise in the cold in a moist atmosphere. The metals are converted to hydrates, and they crumble up into a black powder. The reaction enables every trace of oxygen to be removed from a gaseous mixture containing that gas, and it might have some very useful applications, for example, in manufacturing nitrogen on a small scale.

If the same or like alloys are boiled in water, the metals become converted to their oxides and pure hydrogen is evolved. Here again possible applications suggest themselves, and the hydrates or oxides formed can also be used as bases for the production of such useful salts as basic lead carbonate (white lead) or lead peroxide.

The alloys of zinc and magnesium have similar properties, and Mr. Ashcroft suggests the possibility of using them as substitutes for zinc or tin; for example, in the recovery of gold from cyanide solutions, or as substitutes for pure magnesium in pyrotechnic work.

Where electrical energy is cheap the alloys can readily be made on a commercial scale electrolytically, and Mr. Ashcroft described a cell which he has devised specially for the production of these alloys.

The following papers were also presented at the meeting:—

"On the Equation for the Chemical Equilibrium of Homogeneous Mixtures"; by Prof. A. W. Porter, F.R.S.

"On a Theory of Invar"; by Prof. K. Honda and Mr. H. Takage.

"The Electrolysis of Solution of Sodium Nitrite using a Silver Anode"; by Mr. F. H. Jefferey.

"The Mechanism of the Surface Phenomena of Flotation"; by Mr. J. Langmuir.

WATER POWER IN CANADA.

Some Recent Developments.

We have, from time to time, given details of the steps being taken in Canada to investigate and develop the water power resources of the Dominion. An Order in Council of April 19th last carries the Government organisation a step further, and provides for co-ordination of departments and standardisation of methods, more particularly in respect of the investigation of power resources.

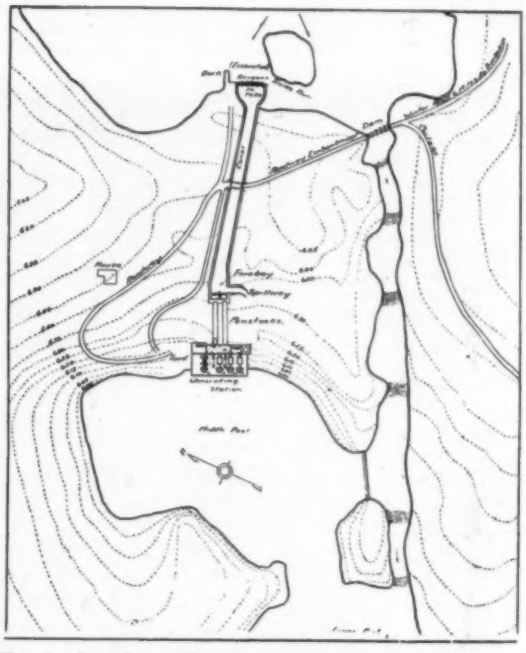

Fig. 1.—Big Chute Power Development, Severn River, Canada.

This order shows that the work of the Dominion Water-Power Branch of the Department of the Interior, in carrying on extensive water resource investigations, has been of such public benefit that urgent requests have been made for similar investigations in other parts of the dominion. According to the *B. of T. Journal*, the Order in Council authorises agreements for this purpose, and provides that such co-opera-

Fig. 2.—Transmission Lines, Severn System, Canada.

tive water resource and power investigations shall be under the control and management of an officer of the Department of the Interior, and shows substantial advancement in a settled policy for standardisation of method in power investigation and centralisation of all information obtained at a central Federal bureau.

Originally the Dominion Water-Power Branch controlled and administered the water resources of the Provinces of Manitoba, Saskatchewan, and Alberta, the north-west territories and the territory of Yukon, and by co-operative arrangement carried on the water resource investigations in the Province of British Columbia. Other provinces which controlled their own natural resources had separate organisations for investigation. In April, 1915, a similar arrangement was entered into with the Province of Nova Scotia, and in May, 1918, with the Province of New Brunswick.

Under the above named Order in Council similar agreements will now be made with the Provinces of Ontario and Prince Edward Island. With the exception of the Province of Quebec, therefore, the water resource investigations for the whole of the Dominion will now be carried out in a uniform manner under the direction of the Federal Director of Water Power. Quebec is not yet reported as having requested direct co-operation, but it is stated that the Quebec Streams Commission is working in close collaboration with the Dominion Power Board and the Dominion Water Power Branch. This advance in collaboration of departments and uniformity of method is largely due to the work of the Dominion Power Board created by an Order in Council on April 25th, 1918.

The Dominion Power Board is an advisory body with the special functions of co-ordinating the development of water and fuel power and consolidating the experience, research and efforts of all the Federal and Provincial departments concerned. It consists of the Minister of the Interior as chairman, with nine permanent department officials as members representing the Departments of Interior, Public Works, Railways and Canals, External Affairs regarding International Waters, Inland Revenue, Mines, the Dominion Railway Commission, and the Hydro-Electric Power Commission of Ontario, and provides for close collaboration with and representation at all conferences of other Government departments.

By means of frequent inter-departmental meetings and annual conferences, at which all bodies are represented, this Board has carried out effective work in co-ordination of effort and prevention of overlapping. It is now investigating many important problems, including the matter of uniformity of water power law and regulations. At present provinces controlling their own natural resources have their individual regulations, and these vary considerably.

The Dominion Water-Power Branch has had in hand for over three years a revision of the Dominion Water-Power Law for districts under the Federal jurisdiction in this respect, and for this purpose has carried out a detailed analysis of the water-power law of all countries. This is probably the most exhaustive investigation of the subject yet made, and it is felt that it might well constitute a basis for a considerable measure of uniformity in water-power law throughout the dominion.

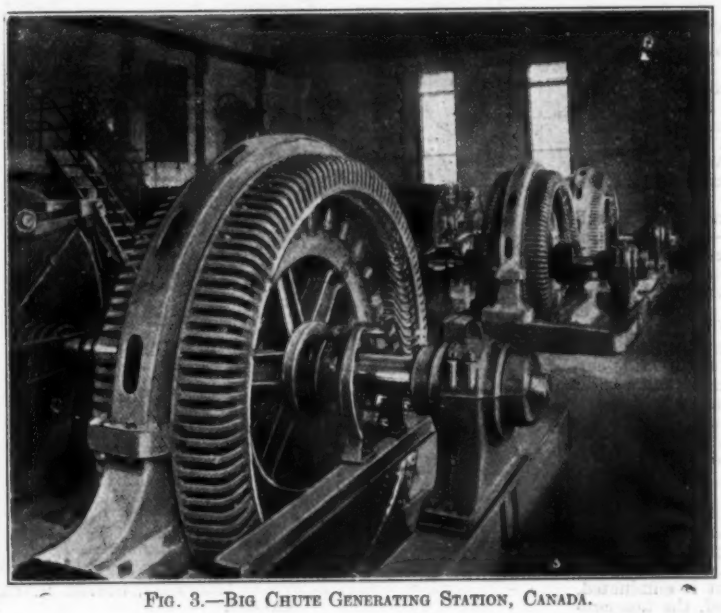

Fig. 3.—Big Chute Generating Station, Canada.

In the *Hydro Bulletin* of May last, a description was given of the generating station extension which completed the power development at the Big Chute site. In the fall of 1909 the Simcoe Railway & Power Co. commenced a development on the Severn river at Big Chute, about 9 miles up from the point where the Severn empties into Georgian Bay (fig. 1). By May, 1911, three 900-H.P. units were installed ready for operation. The company transmitted power at 22,000 volts to its sub-station at Midland. From this station it was distributed at 2,300 volts to the municipality of Midland. The company also proposed to distribute power to any place in the Simcoe county and Muskoka district. In 1911 the Hydro-electric Power Commission of Ontario contracted to take power from the company, and in May, 1911, power was delivered to Midland, and in November to Penetang. In October, 1911, the load on the Big Chute generating station was 350 H.P.; in September, 1912, 550 H.P. In 1913 the number of municipalities supplied by the Commission increased from 2 to 7; the demand in October, 1913, was 1,233 H.P.

Up to 1914 the company owned Big Chute generating station, the transmission lines to Midland, and the Midland station; also a station and distribution system in Victoria Harbour, where the Commission owned the remaining transmission lines and stations. In 1914 the Commission purchased the Simcoe Railway & Power Co., and first operated it on July 1st. In 1915 Wanbanschene and Port McNicoll distributing stations were installed and fed from this system. In 1916 Port McNicoll (Canadian Pacific Railway) and Camp Borden stations were added. In 1918 Alliston, Beeton, Bradford, Cookstown, Thornton, and Tottenham were included in the municipalities fed from this system (fig. 2). In December, 1918, the power development on the Severn system was 6,350 H.P., of which 3,700 H.P. was supplied by the Big Chute station, and the remaining 2,700 H.P. was supplied by the Engenia and Wasdell's systems.

In 1912 a 22,000-volt transmission line was installed by the Orillia Light & Power Co. between Big Chute generating station and Ragged Rapids generating station for interchange of power. This tieline has since been purchased by the Commission and connected to the Swift Rapids generating station, which replaced the Ragged Rapids station. In 1917 the Severn system 22,000-volt transmission lines were connected to the Eugenia system at Collingwood station. The Wasdell's Falls system has a 22,000-volt line connected to the Orillia Water and Light Commission's system at Orillia. Thus the Severn system is connected to the Eugenia and Wasdell's systems and also the Orillia Light & Power Co.'s system, and allows for an interchange of power. In the original development, as installed in 1909, 1910, 1911, there was the canal entrance, canal about 500 ft., forebay and one steel penstock 9 ft. in diameter. The latter is carried on concrete piers for about 150 ft. down the slope, and turns along the rear of the

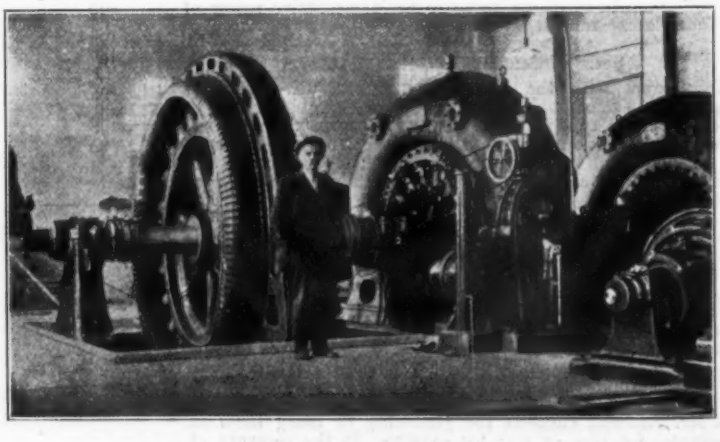

Fig. 4.—New Set in Big Chute Generating Station, Canada.

power house, terminating in a surge tank extending to an elevation 4 ft. above that maintained in the forebay. Nos. 1 and 2 turbines are connected to the penstock by diverging feeders, and No. 3 is connected by a "Y" connection. The turbines were built by Wm. Hamilton & Co., of Peterborough, Ontario, and are of the Samson type, each designed for 1,300-H.P. capacity at 56 ft. head and at 300 R.P.M. The exciter turbines have a capacity of 200 H.P. under 56 ft. head at 580 R.P.M. The hydraulic turbine governors are all of the Lombard oil pressure design. Practically all the electrical equipment was manufactured by the Canadian Westinghouse Co. There were three 900-K.V.A., 2,200-volt, 60-cycle, 3-phase, 300-R.P.M., revolving-field generators (fig. 3). There were two turbine-driven exciters, each of 100 KW., 125 volts, controlled by a Tirrill regulator. There was one bank of three 600-K.V.A., 2,200-25,000-volt, single-phase, 60-cycle, water-cooled transformers. A second bank of similar transformers was installed in 1912 in the same pocket as No. 1 bank; the first bank being rearranged. The switchboard consisted of 12 black marine finished marble panels. The switchboard gallery extends 6 ft. into the generator room, while behind it is the 2,200-volt bus and switch structure and generator rheostats, which are operated by shafts in straight line between rheostat handle and the face plate on the rheostats. For the 220,000-volt transmission lines between the generating station and Midland see fig. 2. Matchedash Bay is about 2,000 ft. across, and two spans were made, 1,153 ft. and 858 ft. respectively. The longer span also crosses the ship canal, and necessitates a 175-ft. tower; the centre and east shore towers are each 88 ft. high.

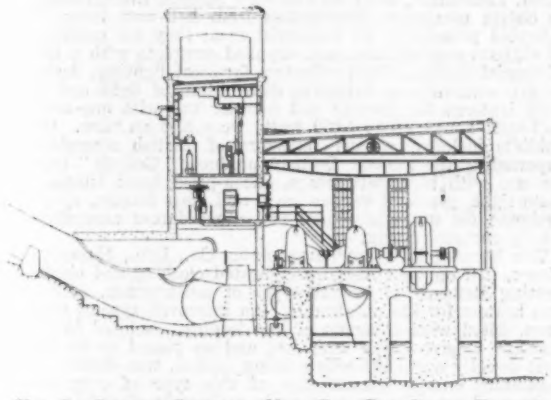

Fig. 5.—Section Showing New Set, Big Chute Power Station, Canada.

When the Commission took over the company in 1914, a number of minor changes were made in the metering equipment at Big Chute generating station to make it conform to the Commission's requirements. In 1917 some 2,200-volt equipment to supply the Department of Railways of Canada for the marine railway installed at Big Chute. It became necessary, early in 1917, to proceed with the extension of the Big Chute generating station. To secure additional capacity, a new penstock and a fourth turbine were required, together with two new valves, head gates, and the necessary power-house substructure and superstructure (figs. 1, 4, and 5). The steel penstock is 9 ft. in diameter and about 170 ft. long. The Wellman-Seaver-Morgan Co. supplied the double-runner, spiral-case turbine (figs. 4 and 5) of 2,300 B.H.P. under a 56-ft. head running at 300 R.P.M. Two 66-in. diameter gate valves with two head-gate mechanisms were supplied by the Boving Hydraulic & Engineering Co., of Lindsay. A 1,600-K.V.A., 300-R.P.M., 2,200-volt, 3-phase, 60-cycle, waterwheel type, horizontal generator was purchased from the Canadian General Electric Co. A flywheel effect of 300,000 lb. ft. sq. was required in the rotor of this generator, which necessitated a large-diameter machine, and was the reason for it being placed so low in the foundations, as the generator shaft had to line up with the turbine shaft. The specifications permitted a maximum temperature rise of 40 deg. C., with a continuous load of 1,600 K.V.A., at 80 per cent. power factor, normal speed and voltage. This generator was tested in the factory at an overspeed of 185 per cent. normal speed for 15 minutes, and an insulation test of 10,000 volts between armature windings and frame was withstood for one minute; the field windings and the field rheostat resistances withstood 1,500 volts for one minute. A heat run was made in the factory, also the necessary measurements were taken to calculate the efficiencies, regulation, &c. No tests were required after installation. This fourth unit, together with the second penstock as mentioned above, were first placed in service and fed power into the system on January 28th, 1919.

When making these extensions it was decided to remodel the H.T. switching room by installing duplicate 22,000-volt busses and making all 22,000-volt oil switches electrically operated. It was also decided to install equipment for one new 22,000-volt outgoing line, and to remodel the 22,000-volt arresters, and to provide space for equipment for two future lines, one to Orillia and the other to Wanbanshene. The present switchboard is to be rearranged in order to provide space for the panels to control the new and future 22,000-volt lines. New 2,200-volt electrically-operated oil switches will be installed for the L.T. side of the transformers, and the present transformer switches will be used for the new generator and for station-service transformers on the L.T. side of each bank of transformers. A second set of disconnecting switches will be installed and the oil switch rearranged so that each bank can be connected to either bus, whereas at present each bank can be connected to only one bus. This extension includes a second transformer pocket, and one bank of transformers will be removed from No. 1 pocket to No. 2 pocket, and the transformers in No. 1 pocket will be arranged. Space is provided in No. 2 pocket for a possible future bank of transformers, also space for a machine shop and an oil storage tank. A spare 600-K.V.A. transformer has been purchased from the Canadian Westinghouse Co., and was to be delivered this spring and installed in No. 1 pocket with permanent 22,000-volt connections and 2,200-volt connections carried to each transformer in No. 1 and No. 2 banks, so that with short temporary connections it can be connected in place of any other transformer during an interruption on that bank of only a few minutes.

Practically all the new equipment was purchased from the Canadian Westinghouse Co., and was delivered during the summer of 1918. The work of installing new equipment and remodeling and removing old equipment is now being proceeded with by the Ontario Hydro-electric Commission's Construction Department, and it was expected that it would be completed early this summer.

(To be continued.)

THE BRITISH SCIENTIFIC PRODUCTS EXHIBITION.

(Concluded from page 235.)

The Igranic Electric Co., Ltd., 147, Queen Victoria Street, London, E.C.4, exhibited a rotary coil-testing set for making and breaking the circuit to electrical coils many thousand times per hour; the set shown had made and broken circuit over a million times. A telfer crane was shown working with two model magnets of the new patent unit type; the magnets were attached to a spreader beam and were shown lifting loads up to the full capacity of the telfer crane. The advantage of this new patent unit type of magnet is that two or more units can readily be connected together to form one larger magnet, and that multiple magnets can be used on higher voltages. Each units is 20 in. × 20 in. on the lifting face, and will lift from 1 to 4 tons, depending on the character of the material to be lifted and the manner in which it is piled or arranged. Combinations of the following sizes can easily be made: 20 in. × 20 in., 20 in. × 40 in., 20 in. × 60 in., 40 in. × 40 in., 40 in. × 60 in., 60 in. × 60 in., or any multiple of 20 in. × 20 in. Each magnet is so wound as to be suitable for use on either 110 volts or 220 volts D.C.

Many varieties of coils were displayed, wound by new methods, in different stages of completion, as described in our issue of August 30th, 1918, page 215. The special features of these coils are: Correct alignment, no variation in resistance and number of turns always identical. The coils are self-supporting and do not require cheeks or bobbins. Each turn and layer of wire is insulated exactly to the degree required, the insulation being thickest where potential difference is greatest. The natural capillary action in impregnating and the special methods employed preclude air pockets. The coils will withstand far greater electrical and mechanical stresses than coils wound by any other method. Large quantities of such coils have been used by the Admiralty and War Departments for wireless and other apparatus. These coils are admirably suited for track signalling, owing to great mechanical strength, absolute reliability and moisture-proof construction.

Various types of automatic starting switches for electric motors were also exhibited, including the following: A pillar-type ironclad panel to completely control a motor driving a machine tool, including starting, speed acceleration and retardation of speed by push buttons, from a number of working stations. A pillar-type ironclad equipment comprising a multiple-finger type direct-current automatic electric motor starter, with various types of master control. A multiple finger type direct-current automatic electric motor starter. A direct-current automatic electric motor starter of the magnetic lock-out type. Series relay type alternating current self-acting electric motor starter for slip ring, two- or three-phase induction motor. An alternating current self-acting electric motor starter suitable for a two- or three-phase squirrel-cage induction motor. Treadle-operated starter and speed regulator for the control of sewing machines with individual motor drive. This device was specially designed for sewing machines and other small treadle-operated machines; it is standardised for 1/10, 1/8, 1/7, 1/6, 1/5 and 1/4 H.P. at 110-115 and 200-230 volts for series, shunt and compound-wound motors. Special features are its compact construction: it is simple to fix and easy to clean; perfect speed control is given by a large number of contacts with spring return, a quick stop is obtainable, and

the dynamic brake stops the motor, but does not interfere with turning the machine by hand. No friction brake is required, and a magnetic blow-out prevents arcing. Fig. 24 shows the regulator with the front of the housing removed to permit cleaning, while fig. 23 shows the device fitted to a sewing machine. By depressing the treadle the regulator starts, accelerates, and controls the speed of the motor, and by releasing the treadle the motor is stopped. A spring is fitted to the regulator spindle for this purpose. In stopping, the circuit is broken by the disk which engages on the two lower posts, which are magnetised and thus hold the disk in engagement until the spring forces it away, giving a quick break and at the same time forming a magnetic blowout, which prevents any injurious arcing. To obtain a quick stop the treadle is forced up so that the disk is made to engage with the upper two posts, which completes a short circuit of the armature. This forms dynamic breaking, but does not prevent the machine being turned by hand for setting the work. The resistance is mounted at the back of the regulator, the whole being enclosed in a cast-iron case. The contact brush is of carbon and readily renewable. The overall dimensions of the regulator are 7.5 in. long, 6 in. wide, and 4.5 in. deep.

The Morgan Crucible Co., Ltd., Battersea Works, Church Road, London, S.W.11, exhibited "Morganite," "Copper-Morganite," electrographitic, and "Battersea" carbon brushes in great variety for use on D.C. dynamos and motors, alternator and induction motor slip rings, rotary converters and other types of rotating electrical plant. Magneto carbons for the distributors and slip rings of aeroplane and automobile magnetos and battery carbon rods for pocket flash-lamp cells

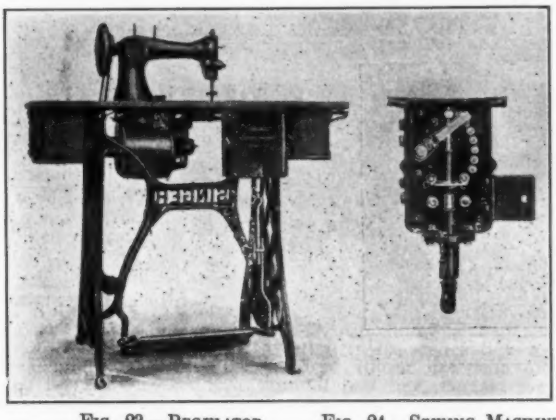

Fig. 23.—Regulator Fitted to Sewing Machine.

Fig. 24.—Sewing Machine Starter and Regulator.

were shown, as were also "Morganite" bearings, dashpot plungers, rheostat plates, switch contacts, &c., and samples of various sizes and types of "Morganite" packings for steam-turbine glands as supplied to the requirements of the British Navy.

Salamander crucibles for melting metals and alloys with special patterns for case hardening, tempering spindles, and carbonising electric-lamp filaments were exhibited, as well as patent electrically-heated crucibles and crucible troughs for melting non-ferrous metals and tubes for heat treatment of metals. These are new inventions, some of which were recently described in our pages.* Other exhibits by this firm included the following:—Salamander retorts for the distillation and purification of zinc and for the production of zinc oxide; plumbago especially prepared for iron, steel and brass castings, with special grades for lubricating, electroplating, gunpowder for the electrical trades and other purposes.

The Cowper-Coles Manufacturing Co., French Street, Sunbury-on-Thames, exhibited electrolytic products, including samples of various products made or coated electrolytically, such as seamless copper fittings and copper tubing, lead-lined chemical vessels and lead plating; flexible zinc coating, and inlaid decorative metal work. Sherardising by an improved process was illustrated, as were also brass plating, reproduction of pewter ware, and detonator tubes made in two operations.

Messrs. Bryant Symons & Co., 320, St. John Street, London, E.C.1, were showing high-precision, screw-cutting lathes and standard English thread and translating metric thread equipment for use therewith. The latter is arranged to provide suitable wheels and apparatus for cutting all B.A. threads Nos. 0 to 12 and all Systeme Internationale and French threads to 3 mm. pitch. The machines are of British design and construction throughout, and a certificate of examination from the National Physical Laboratory as guarantee of pitch accuracy has been granted.

The Budenberg Gauge Co., Ltd., Woodfield Road, Broadheath, near Manchester, exhibits included varieties of pressure gauges, one type being an electric-control pressure gauge with insulated electric contacts for H.T. currents. This is a recent development of the company's well-known electric-control gauges for use in connection with electric compressors, for the purpose of making an electric circuit, by which the motor operating the compressor is switched on or off when certain limits of pressure are reached. The gauge shown was one of a type which had been designed specially to suit the particular requirements of one of the company's customers, and a great number of these have been made during the war. It is a handsome and robust design with a wide range of adjustment and convenient access. The firm lists a range of control gauges for L.T. currents and also one for H.T. currents, available for currents up to 0.2 amp. at 65 volts, 0.1 amp. at 220 volts, and 0.05 amp. at 500 volts. In this instrument a platinum rod attached to the pointer makes the contact, and all the parts conveying current are insulated by vulcanite coverings. We are given to understand the firm is prepared to work out special designs similar to that exhibited for any particular requirement.

Messrs. Barr & Stroud, Ltd., Anniesland, Glasgow, W., exhibited amongst other things various fire control instruments for gunnery, torpedo, and other purposes; also watertight-door electric indicators and an optophone, a selenium instrument to enable the blind to read ordinary printed type, which we described last year.*

The Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester, had a variety of accumulators on view, including "Exide" patent unspillable accumulators for aircraft and batteries for motor-car starting and lighting; "Ironclad Exide" accumulators for electric vehicles and trucks, and "Chloride" accumulators for ships' wireless purposes. A selection of electric hand lamps for Admiralty and factory use were also shown.

The Benjamin Electric, Ltd., Brantwood Works, Tariff Road, Tottenham, N. 17, had on view reflector fittings designed to obtain maximum illumination from half-watt lamps, and intended principally for industrial uses; they are constructed of vitreous enamel steel, and supplied complete with a holder of special design. Steel reflectors for local lighting, designed to give extensive or intensive distribution of light and half-watt lanterns for interior and exterior use with one-watt or half-watt lamps up to 1,000 watts were also on view. Other exhibits included conical reflectors of British manufacture superseding the pre-war German product, "Goliath" holders for use with high-watt lamps, shock-proof hand lamps, and watertight, gas- and vapour-proof well glass fittings, specially designed for use where acid and other fumes necessitate a totally enclosed fitting.

The British Electric Transformer Co., Ltd., Hayes, Middlesex, had on view electrically heated clothing and electrical heating elements of various types of construction, including gun heaters for use on aircraft. An improved type of electric oven, fitted with elements of low loading, enclosed in gilled castings to give quick radiation, and so placed as to throw heat directly on to the article being cooked, was shown. The maximum energy consumption of this type of oven is 1.5 units per hour. Demonstrations in cooking by electricity were also given. Electric fires, fitted with patent elements fixed in a vertical position to give the effect of a coal fire when in operation, were shown. The resistance wire is suspended in air between the mica insulation at each side of the bar. Immediately above the elements is placed a cast convector, which picks up the heat from the radiant fire bars, and by means of the air slots above the convector, causes an air circulation, and thus drives the heat forward into the room.

The Dallison Gearing and Motor Co., 86-87, Bishopsgate Street, Birmingham, exhibited a self-controlled magnetic instrument pilot for steering ships and other craft. The device, it is claimed, can be controlled from shore or aircraft, and can be set to follow the ship's chart or alter the course whilst the ship is on the way without anyone on board.

The Damard Lacquer Co., Ltd., 98, Bradford Street, Birmingham, showed synthetic condensation products for electrical and heat insulation under the trade-mark name of "Formite." These products are quite soluble and fusible in the intermediate state, but on the continued application of heat at a temperature of 120-130 deg. C., they change chemically into an inert and insoluble form, "Formite B," which is no longer fusible and is unaffected by hot oils, spirit solvents generally, and most chemicals. In the intermediate, or "A" state it has a similar appearance and behaviour to resin, while in the "B" or final state it has the appearance of pure amber. It is in this latter state that it is said to exhibit high insulating properties. Various products were on view, also varnish for paper and coil insulation, moulding mixtures, and rods.

Mr. H. E. Davies, 11, Sun Street, London, E.C.2, exhibited "Delcoblast," a preparation for obscuring electric lamp globes and other glass. By placing the glass in the solution for 20 or 30 seconds and afterwards wiping it with a damp sponge, a frosting equal to sandblasting can be obtained. It can also be used as an ink for rubber stamps for marking glass.

The Electric Welding Co., Ltd., 28, Basinghall Street, London, E.C.2, had an electric welding machine on view for welding iron and steel wires from 0.05 in. to 0.2 in. diameter, and copper wire from 0.05 in. to 0.175 in. diameter. Among other uses to which the machine can be put are the following: jointing ends of wires in the manufacture of electric cables, including the galvanised steel wire employed for armouring submarine cables, and also for making small rings, buckles, and similar wire articles. The weld is made in from one to five seconds with an expenditure of from one to 4 KW:

*Elec. Rev., March 28th, 1919, p. 342.

*Elec. Rev., September 13th, 1918, p. 249.

the machine may be operated from any single-phase A.C. supply. The welder is electrically automatic, and has two clamps, one stationary and the other movable by means of an adjustable pressure spring. The clamps are adjustable for different sizes of wire. The wires being clamped in position, the circuit is closed by an external switch and a button switch on the top of the welder pressed down; the wires in clamps, one stationary and the other movable by means of the spring, the circuit being operated by means of an adjustable automatic cut-out device. A swelling or burr is left around the weld, the size of which depends on the tension of the spring and the setting of the cut-out.

Fuller's United Electric Works, Ltd., Chadwell Heath, Essex, showed a collection of electrical appliances and accessories, including accumulators of various types and sizes, dry batteries, pocket and hand electric lamps, carbons, &c.

The Micanite & Insulators Co., Ltd., Blackhorse Lane, Walthamstow, E.17, exhibited "Micanite" products in the form of small mica splittings cemented together in layers by suitable insulating varnish. This well-known form of insulation was shown in sheet form in various grades, serving to illustrate some of the many purposes for which it can be adapted. Also a range of commutator cones or end rings served to show the various designs which are in use. Oiled insulating clothes and tapes were shown, as were also "Paxolin" insulating materials, which are built up with suitable paper impregnated with a synthetic varnish which is a condensation product of phenol and formaldehyde. This product also serves as the chief base from which "Formalite" moulding material is manufactured. Mica was on view both in the form of original block as lifted from the mines and in that of splittings.

The Osmosis Co., Ltd., 36, Victoria Street, London, S.W.1, exhibited raw and purified samples illustrating the electrical purification of clays.

Messrs. Chas. Hearson & Co., Ltd., 235, Regent Street, W.1, exhibited, amongst other things, a collection of electrically heated apparatus, including incubators, sterilisers, drying ovens, &c.

Messrs. Nalder Bros. & Thompson, Ltd., 97a, Dalston Lane, E.8, showed electrical measuring instruments for all purposes made in the switchboard, portable, and chart-recording types. The moving-iron and moving-coil types of instruments are fitted into a large selection of cases, round cases having dial diameters of from 3 to 11 in.; the edgewise instruments have a scale length of 5, 8 and 11 in., the latter with illuminated dial if necessary; and the sector shape cases have a length of scale of from 4 to 21 in. These can be fitted with either plain or illuminated dials. Dynomometer type instruments are fitted in 6, 8, and 11 in. dial round cases; and the induction type has an 8-in. round case and is also available in large sector cases. Portable instruments are made in two styles; first grade are mounted in polished wood cases with white enamelled scales, while in the sub-standard pattern, mirror scales and edgewise pointers and lock-up polished wood cases are provided. The 24-hour pattern, single-revolution drum type recording instruments give a paper speed of 9/16 in. per hour; and the continuous record pattern give 65 ft. length of chart with various paper speeds. They are the soft-iron and moving-coil types, and the dynamometer type for wattmeters. "N.C.S." insulation test sets are made in electrostatic and permanent-magnet types; the former is light and unaffected by external fields, the latter is slightly heavier, has a longer scale, and is rather more dead-beat in action. The construction of instruments of the induction dynamometer type involves a new principle of introducing the current into a moving system of an instrument through a transformer with a floating secondary coil. This principle enables synchronisers and power-factor meters to be constructed for circuits up to 600 volts without extra resistance. The Fawcett-Parry sensitive relay, various types of relay for both A.C. and D.C., working automatic switches, and circuit breakers were also shown.

The Watford Electric and Manufacturing Co., Ltd., Watford West, Hertfordshire, exhibited a reversing lift or hoist controller for use with D.C. motors, and designed for use with a plain up, down, and stop car switch in the lift; or for use with a completely automatic push-button control. Landing buttons are provided for calling to each floor where the cage stops, and a set of push buttons in the cage is then used for taking it to any other floor. A reversing controller for hand rope operation was also shown, and with a patent automatic D.C. motor starter were shown a pedal-switch starter as used for capstan operation, start and stop push buttons, a float switch actuating pumps, and D.C. and A.C. contactor switches, the latter as used for heavy-duty starters and controllers.

Automatic Electric Furnaces, Ltd., 281, Gray's Inn Road, London, W.C.1, exhibited a number of Wild-Barfield automatic electric furnaces which were shown complete with quenching or tempering baths, automatic detectors, compensators, switches, &c. A 2-in. laboratory and research muffle with pyroscopic winding and automatic detector for determining the change point, &c., of steels was also on view, as well as an electrically-heated tempering bath having the following dimensions: Bore, 16 in.; depth, 17 in.; maximum consumption, 1,800 watts; maximum weight, 10 lb.; maximum length, 12 in.; and a capacity of 30 lb. per hour. The magnetic sclerometer shown consisted of a plain cylinder, 3 in. by 0.5 in., which is given the heat treatment that it is desired to investigate. It is then tested for magnetic coercive force by first magnetising it to saturation, and then measuring the open circuit remanence with a suitably calibrated fluxmeter and search coil.

August's Muffle Furnaces, Ltd., King's Cross, Halifax, exhibited standard solid-fuel and gas-fired furnaces, also the Chattaway-Mills hardness testing machine, which was evolved during the war to get over the difficulties and uncertainties in other types of machines with reference to some specifications. The chief point of this machine is that it is a direct-load machine, and gives a consistent test each time, irrespective of the individual working it. Working electric furnaces should also have been on exhibit as follows: An electric brass-melting furnace, a combination hardening furnace, and a rotary furnace. The latter was delivered at the exhibition rather late, but the brass-melting furnace and combination hardening furnace unfortunately, through delays, could not be exhibited. It is hoped, however, to exhibit these at the Olympia Exhibition in September.

We might add that this firm holds the joint selling rights with Messrs. Barfield of the Wild-Barfield apparatus, the latter firm manufacturing electric furnaces and the former manufacturing solid fuel furnaces designed to work their equipment, both parties selling jointly each type of furnace. This firm is particularly interested in electric furnaces for the moment up to temperatures of 1,000 deg. C., and considers that future requirements, although they are covered to-day by the standard furnaces up to such temperatures, will with the great strides which are taking place in heat treatment steels, require steadier and more uniform temperatures of such a kind that can only be produced by electricity. This firm is, therefore, concentrating on developing this type of furnace so as to put it in a position to offer customers apparatus which will fully carry out and accomplish their desires as regards heat treatment, &c.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Quiklok" Ceiling Rose.

Of all the worries which beset the daily life of the electrical wireman, we should imagine that none can have caused more frequent annoyance that the labour involved in connecting flexible cord to the ordinary ceiling rose. The unfortunate fellow has to balance himself on the top of a step ladder, take the weight of the pendant in one hand, while he attempts to guide the ends of the wires into the terminals with the other. The British Thomson-Houston Co., Ltd., 77, Upper Thames Street, London, E.C.4, has put on the market the "Quiklok" ceiling rose, which obviates in a very simple manner the above-mentioned difficulty. The distinguishing feature of this ceiling rose, fig. 1, is that the terminals are contained in the cover, and can therefore be wired up in comfort on the ground. The B.T.H. "Quiklok" ceiling rose is made in two patterns—one for ordinary and the other for cleat wiring—and, if desired, either pattern can be supplied with fuse contacts in the cover. It is obvious that these ceiling roses, if used on a job involving a hundred or so points, would save a considerable amount of time, to say nothing of eliminating a source of irritation. Fig. 1 shows the rose with the terminals

Fig. 1.—B.T.H. "Quiklok" Ceiling Rose.

in the cover; the method of wiring and fixing the rose is as follows: First, the base is screwed to the ceiling, next the terminals in the cover are wired up, which operation can be done at the bench, and finally the cover is fixed to the base by a quarter turn.

A Portable Safety Motion-Picture Projector.

A motion-picture projector for homes and schools, using a special, narrow-width, slow-burning film is now being manufactured by the Pathéscope Company of America. One of its most important advantages is that the machine can be operated without an inclosing fireproof booth or a licensed

operator, since both the projector and the films it uses are labelled with the approval of the Underwriters' Laboratories, Inc. As additional features the maker declares that the new projector produces on the screen approximately ten times as much illumination for each watt burned in its lamp as the most efficient illumination system employed on other machines; 62½ per cent. of the light illuminating the film is utilised as compared to the customary 32 and 47 per cent., and an absolutely flickerless picture is projected on the screen. The projector employs a specially designed 14-volt, 2-amp. or 4-amp. gas-filled incandescent lamp in an adjustable socket with a self-centring support. A Westinghouse universal motor operates the machine and rewinds the film. The speed control consists of a light brake applied to the side of the fly-wheel by a knurled knob conveniently located near the lens on the operating side of the machine. Motors are supplied for operation on 110 to 120 volts and also for 32 volts and 220 volts. The weight of the machine, including the motor, is 23 lb. For convenience in transportation a "suitcase" to hold the projector can be obtained and also a metal carrying-case with a baseboard.—*Electrical World*.

NEW PATENTS APPLIED FOR, 1919.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEPTON-JONES, O'DELL AND STEPHENS (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

19,669. "Magneto motor acting by repulsive movements between double poles." D. SUCHOSTAWER. August 11th.
19,686. "Electrodes for electric furnaces." W. BRANFIELD. August 11th.
19,699. "Electromagnetic step-by-step, &c., mechanism." C. L. WALKER. August 11th.
19,709. "Telegraph systems." WESTERN ELECTRIC CO. (Western Electric Co.) August 11th.
19,713. "Dry batteries." E. E. G. BOITE and T. E. SLAUGHTER. August 11th.
19,717. "Manufacture of dry batteries for pocket electric lamps." M. ZEILER. August 11th.
19,718. "Interrupters in ignition apparatus for internal-combustion engines." SCINTILLA. August 11th. (Switzerland, September 13th, 1918.)
19,719. "Bearing and plates for ignition apparatus of internal-combustion engines." SCINTILLA. August 11th. (Switzerland, September 3rd, 1918.)
19,720. "Horse-shoe magnets." SCINTILLA. August 11th. (Switzerland, August 29th, 1918.)
19,721. "Magneto-electric ignition apparatus for internal-combustion engines." SCINTILLA. August 11th. (Switzerland, September 13th, 1918.)
19,722. "Interrupters for magneto-electric ignition machines for internal-combustion engines." SCINTILLA. August 11th. (Switzerland, September 13th, 1918.)
19,723. "Means for attaching handle for varying point of ignition to interrupter in electric ignition dynamos." SCINTILLA. August 11th. (Switzerland, September 13th, 1918.)
19,724. "Cable outlets of magneto-electric ignition machines for internal-combustion engines." SCINTILLA. August 11th. (Germany, October 1st, 1918.)
19,725. "Distributors for high-voltage current of magneto-electric ignition machines." SCINTILLA. August 11th. (Germany, October 1st, 1918.)
19,726. "High-tension distributors in magneto-electric ignition machines." SCINTILLA. August 11th. (Switzerland, September 28th, 1918.)
19,730. "Electric pocket lamps." NURNBERGER METALL-UND LACKIERWAARENFABRIK VORM GEB. BING AKT-GES. August 11th. (Germany, October 10th, 1916.)
19,762. "Preservation of wooden telegraph poles, &c." R. M. ROBERTS. August 12th.
19,799. "Electric signalling systems." WESTERN ELECTRIC CO. (Western Electric Co.) August 12th.
19,801. "Crossovers of overhead conductors for electric traction." E. M. MUNRO. August 12th.
19,837. "Magnetos." J. BERNARD. August 12th. (France, June 7th, 1917.)
19,845. "Electric heaters." R. HILL. August 12th.
19,852. "Electric resistance elements." W. TRAVIS and T. H. WATSON & CO. August 13th.
19,873. "Electric machinery." H. A. ROBERTS. August 13th.
19,895. "Galvanic batteries." G. FULLER, G. J. A. FULLER & L. FULLER. August 13th.
19,903. "Electric heater units." L. V. LEONARD. August 13th.
19,905. "Removable electric fuse carrier." W. T. HENLEY'S TELEGRAPH WORKS & W. S. WAKEFIELD. August 13th.
19,906. "Electric heating apparatus." E. H. JONES. August 13th.
19,953. "Commutators for electric ignition systems, &c." F. W. BAKER. August 14th.
19,975. "Engine room telegraphs." A. A. H. HAMMER. August 14th.
19,983. "Electric switch mechanism." ELECTRICAL APPARATUS CO. & A. J. MARTIN. August 14th.
19,986. "Electric motor starters, controllers, and field regulators." A. L. TACKLEY. August 14th.
19,994. "Commutators for motor-cars." J. W. LAW. August 14th.
20,000. "Gear embodying electric controllers for winches, &c." CLARKE, CHAPMAN & CO. & R. C. HARRIS. August 14th.
20,006. "Sparking plug tester." J. HANMAN. August 14th.
20,012. "Electric cigar, &c., lighters." R. J. H. HELL & M. J. RAILING. August 14th.
20,025. "Electric lamp holders. H. GARDE. August 14th.
20,029. "Circuits for cascade amplifying." GENERAL ELECTRIC CO. & B. S. GOSSLING. August 14th.
20,034. "Electric furnaces." D. F. CAMPBELL. August 14th.
20,043. "Aerial systems for wireless telegraphy, &c." C. S. FRANKLIN. August 14th.
20,052. "Wireless receiving systems." J. SCOTT-TAGGART. August 14th.
20,054. "Sparking plugs." H. W. DUFFIELD. August 15th.
20,072. "Lamp signalling attachment for electric torches." C. G. MANTON. August 15th.
20,073. "Ignition system for gas engines." G. HONEYSCHLAGER. August 15th.
20,081. "Electric welding." R. F. WOODBURN. August 15th.
20,096. "Electrolyte for deposition or iron." S. O. COWPER-COLES. August 15th.
20,114. "High voltage insulators." F. JAENTSCH. August 15th (Germany, February 6th).
20,137. "Incandescent electric lighting apparatus." C. VON DER WEID. August 15th. (Switzerland, September 13th, 1918.)
20,149. "Insulating caps for electric joints." M. RITSEMA. August 16th. (Holland, September 18th, 1918.)
20,170. "Electrical rectifier." A. G. BULLEN. August 16th.
20,188. "Devices for preventing taking off of current from electric conductors." R. DELLA GIACOMA. August 16th. (Switzerland, February 18th.)
20,193. "Moter for railway signalling, &c." AUTOMATIC TELEPHONE MANUFACTURING CO. & A. E. HUDD. August 16th.
20,195. "Electro magnetic switches." BRITISH THOMSON-HOUSTON CO. (General Electric Co.) August 16th.
20,197. "Electrical batteries." W. T. COULSON & OPTALYTE, LTD. August 16th.
20,198. "Lamps and lamp holders." C. F. VAUGHAN. August 16th.
20,202. "Electric locomotives." T. ZWERGBERGK. August 16th.
20,206. "Sparking plug tester." J. HANMAN. August 16th.
20,216. "Method of electrolytic tinning and electrolytic fluid for same." E. HARBECK. August 16th.
20,219. "Wire attachments for electric connections." ETABLISSEMENTS BELIN. August 16th. (France, March 8th.)
20,220. "Sparking plugs." W. G. IKIN. August 16th.

PUBLISHED SPECIFICATIONS.

The numbers in parenthesis are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

16,713. MANUFACTURE OF INCANDESCENT LAMPS. Deutsche Gasgluhlicht Akt-Ges. (Auerges). November 14th, 1916. (111,298.)
18,603. PROJECTOR ARC LAMPS. J. Bruckie and Johnson & Phillips. December 14th, 1917. (130,011.)
18,621. AUDION OR LAMP RELAY OR AMPLIFYING APPARATUS. M. Latour. November 30th, 1916. (Addition to 3,140/18.) (130,012.)
18,753. DYNAMO ELECTRIC MACHINES. M. Latour. December 17th, 1917. (Patent of addition not granted.) (130,014.)
18,876. ELECTRIC ARC FURNACES. H. Coates and Waterford Electric and Manufacturing Co. December 19th, 1917. (130,030.)
18,920. AUDION OR LAMP RELAY OR AMPLIFYING APPARATUS. M. Latour. December 20th, 1916. (Addition to 5,363/17.) (130,022.)
19,082. DIAPHRAGMS FOR ELECTROLYTIC CELLS. Chemische Fabrik Weinenstein Ges. and R. Walter. December 19th, 1916. (112,446.)

1918.

120. VACUUM TUBES. G. A. Beauvais. August 1st, 1917. (130,039.)
121. VACUUM TUBES. G. A. Beauvais. August 4th, 1917. (130,040.)
336. AUDION OR LAMP RELAY OR AMPLIFYING APPARATUS. M. Latour. January 9th, 1918. (Addition to 5,363/17.) (130,046.)
673. VENTILATING DEVICES FOR ELECTRIC MACHINERY OR APPARATUS. Siemens-Schuckertwerke. December 22nd, 1916. (112,939.)
676. WIRELESS SIGNALLING SYSTEMS. British Thomson-Houston Co. (General Electric Co.) January 11th, 1918. (130,064.)
1,109. WIRELESS SIGNALLING SYSTEMS. British Thomson-Houston Co. (General Electric Co.) January 19th, 1918. (130,090.)
1,377. STEP-BY-STEP TELEGRAPHIC AND LIKE RECEIVERS WORKING ON THE PRINCIPLE OF MAGNETIC GEARING. Barr & Stroud and C. D. Macgill. January 24th, 1918. (130,094.)
3,140. AUDION OR LAMP RELAYS OR AMPLIFYING APPARATUS. M. Latour. April 15th, 1916. (Divided application on 5,363/17.) (130,103.)
6,991. APPARATUS FOR ELIMINATING INTERFERENCE IN WIRELESS TELEGRAPHY. Marconi's Wireless Telegraph Co. and H. Richmond. April 25th, 1918. (130,107.)
10,531. MAGNET STEEL. Sumitomo Chukosho, Ltd. June 15th, 1917. (118,601.)
10,834. MAGNET STEEL. Sumitomo Chukosho, Ltd. July 10th, 1917. (118,602.)
11,619. SPARKING PLUGS FOR INTERNAL-COMBUSTION ENGINES. H. G. Longford, W. W. Longford and W. A. Clark. July 16th, 1918. (130,122.)
11,857. AUTOMATIC OR SEMI-AUTOMATIC TELEPHONE SYSTEMS. E. A. Laidlaw. July 19th, 1918. (130,131.)
11,984. WINDING WIRE GRIDS FOR ELECTRIC RESISTANCE. W. F. Jones. July 23rd, 1918. (130,137.)
12,071. TELL-TALE SWITCHBOARDS. L. E. Jaynes. July 24th, 1918. (130,149.)
12,154. IGNITION DEVICES FOR INTERNAL-COMBUSTION ENGINES. Splitdorf Electrical Co. July 25th, 1917. (118,105.)
12,214. METHOD AND APPARATUS FOR ELECTRICALLY OPERATING MECHANISMS FROM A DISTANCE. (Cognate application 13,156/18.) A. G. Bloxam (Russische Akt-Ges. L. M. Ericsson & Co.) July 26th, 1918. (130,162.)
12,642. FEEDING POLYPHASE CURRENT CIRCUITS FROM A MONOPHASE CURRENT SOURCE. T. Buess and H. Gutzwiller. August 6th, 1917. (118,618.)
12,643. ELECTRIC HEATING ELEMENTS. J. A. Colquhoun. August 2nd, 1918. (130,172.)
13,284. X-RAY APPARATUS. F. J. Brougham. (M. Deutsh.) August 15th, 1918. (130,186.)
13,390. ELECTRIC SAFETY LAMPS. Fuller Accumulator Co. and A. P. Welch. August 17th, 1918. (130,187.)
13,698. ELECTRICAL DEVICE FOR AUTOMATICALLY INDICATING BY VISUAL OR AUDIBLE MEANS THE CORRECT TEMPERATURE OF ELECTRICALLY HEATED STEEL BEFORE QUENCHING IN ORDER TO OBTAIN CORRECT HARDENING THEREOF. H. Alexander, W. T. Vint and A. M. Imbery. August 22nd, 1918. (130,191.)
14,400. ELECTRIC MELTING FURNACES. T. F. Baily and F. T. Cope. September 4th, 1917. (119,234.)
15,302. ELECTRIC FURNACES. J. R. Hoyle and P. W. Fawcett. September 20th, 1918. (Cognate application 222/19.) (130,205.)
15,461. ELECTRIC CONTACTORS. British Thomson-Houston Co. (General Electric Co.) September 23rd, 1918. (130,206.)
15,564. MARINERS COMPASSES. L. T. Bates. October 1st, 1917. (130,379.)
15,652. DIAPHRAGMS. Automatic Telephone Manufacturing Co. and S. R. Smith. September 26th, 1918. (130,210.)
15,694. HERMETIC SEALS FOR THE LEADING-IN WIRES OF ELECTRIC LAMPS AND LIKE APPARATUSES. British Thomson-Houston Co. (General Electric Co.) September 26th, 1918. (130,212.)
16,297. MODULATING METHOD AND APPARATUS FOR HIGH-FREQUENCY ELECTRICAL SIGNALLING. Western Electric Co. (Western Electric Co.) October 7th, 1918. (130,219.)
16,536. BAYONET JOINT SOCKETS FOR ELECTRIC LAMPS. F. J. O'Neill. October 10th, 1918. (130,220.)
17,034. SPARKING PLUG. H. S. Cooke. October 18th, 1918. (130,228.)
17,732. SYSTEMS OF ELECTRIC DISTRIBUTION. British Thomson-Houston Co. (General Electric Co.) October 30th, 1918. (130,232.)
17,735. ELECTRICAL CONNECTION FITTINGS. J. A. McKay. October 30th, 1918. (130,233.)
20,558. SLOW ACTING DEVICES FOR USE WITH RAILWAY SWITCHES, SIGNALS, AND FOR OTHER PURPOSES. McKenzie Holland Westinghouse Power Signal Co. May 14th, 1918. (126,939.)

1919.

591. MACHINES FOR COVERING WIRE WITH SILK, COTTON, OR THE LIKE. J. Narizzano. January 8th, 1918. (130,266.)
895. TRACK APPLIANCE FOR AUTOMATIC TRAIN STOPS. M. B. Bulla. December 6th, 1917. (Divided application on 18,103/17.) (130,267.)
2,235. ELECTRIC FUSE AND CIRCUIT TESTERS. L. D. Johnson. April 7th, 1916. (123,066.)
2,585. APPARATUS FOR ELECTRIC WAVE TRANSMISSION PARTICULARLY APPLICABLE TO TELEPHONY. C. D. Ehret. February 1st, 1918. (123,081.)
3,370. INSULATED JOINTS FOR ELECTRIC CONDUCTORS. W. A. Walshaw. February 11th, 1919. (130,279.)
5,212. ELECTRIC FURNACES. G. Marriott. March 3rd, 1919. (130,288.)
5,214. MEANS FOR SUPPORTING IGNITION APPARATUS IN INTERNAL-COMBUSTION ENGINES. Crossley Motors, Lt., and T. D. Wishart. March 3rd, 1919. (130,289.)
5,505. ELECTRIC MOTOR CONTROL SYSTEMS. H. Crochat Etablissements. November 19th, 1918. (130,291.)
10,314. ELECTROLYTIC PROCESS FOR COATING IRON OR STEEL WITH LEAD OR ANTIMONY OR AN ALLOY OF LEAD AND ANTIMONY. O. Marino and C. Bowen. April 29th, 1918. (Divided application on 7,175/18.) (130,303.)
10,490. TREATMENT OF ZINC BEARING ORES FOR THE RECOVERY OF ZINC BY ELECTRO-DEPOSITION. Electrolytic Zinc Co., of Australasia. April 27th, 1918. (126,296.)
15,067. ELECTRO-MAGNETICALLY-ACTUATED SWITCHES. British Westinghouse Electric and Manufacturing Co. June 21st, 1918. (128,562.)